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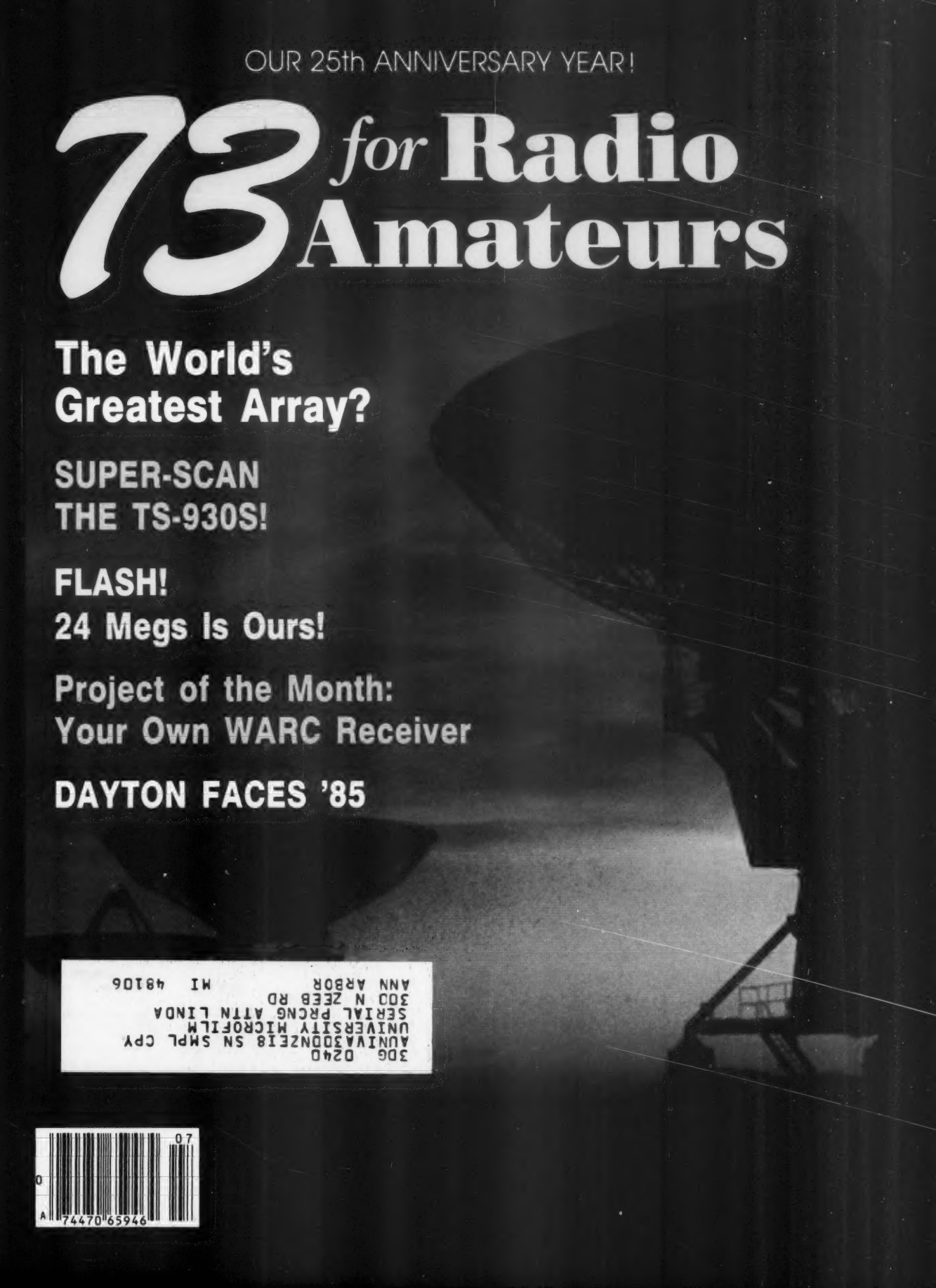

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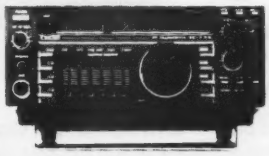

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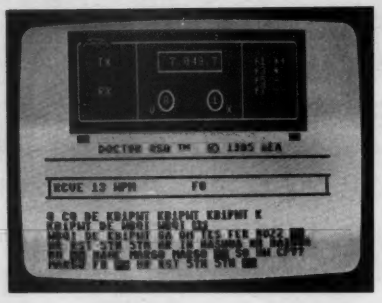

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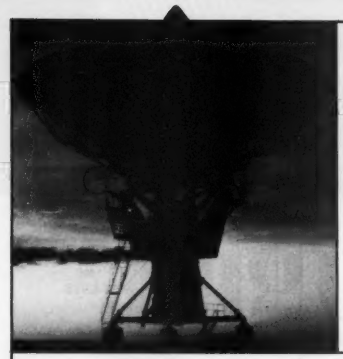

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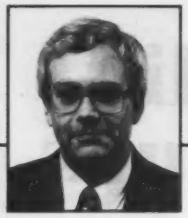

WHAT?

News from the Publisher

People have called and written with regard to the last person we contacted in our February telephone survey: the pickle-trucker from Washington State who turned out to be a Novice. What they want to know is who was the *first* person we contacted. Hello, E.

I made the first of our hundred calls to an OM on an island on the east coast. As bad luck would have it, he's a Silent Key—one of three whose calls we happened to select at random. E is his XYL. She was really nice and felt really honored to be called, I think, but she certainly was adamant: "I want to do the survey for him." I'm sorry, you really can't. "I took down his aerial myself." I know, but our survey wouldn't be accurate if you were the one who answered. "You're right." And then she said this: "Would you tell hams that they mean a lot to me?" I said I'd try.

KA8UET and W8IZF were adamant, too—at the Dayton Hamvention. "We've tried to talk to other people, but they won't listen." I promised them that their views would at least be *seen* in *73*. They want more articles about QRP rigs in all publications, they want VEs of any class to be able to administer tests for their own license level or lower, and they think that a small part of 160 might be a good place to try Novice phone. There! Let it never be said that we don't hear our readers. Speaking of which, we talk with our readers, too, on a regular basis. If you're a letter-writer, complimentary or critical, you might get a landline call from me. Hello, Snohomish, for example.

Dayton was alluring and addictive, as usual. It was a friendly frenzy. How can I describe to those of you who weren't there what it's like to see 24,000 people running around with beady eyes for three days trying to figure out what to buy next? I don't know what to say about DARA, either. Is the Dayton Amateur Radio Association efficient? Sure. The best club in the US? Maybe. Best in the world? Possibly. Able to cope with 30,000 next year? We will see. Don't bet against it.

Do bet on me saying something I meant to last year but didn't: Thank you, everyone I've met in the Dayton area, for being so cordial and courteous and helpful. You go out of your way. I saw somebody from out of town see one of your red, white, and blue trash bins and say, "Hey, an All-American city!" He was surprised. I wasn't. Thanks again.

Thanks, too, to Don Wallace W6AM. I tried to think of some sort of obituary-type key-is-silent thing to write to let you know that he passed away on May 25th. I couldn't. If you, like me, were one of the scores of thousands of people who had the honor of speaking with Don, I hope you'll agree that "thanks" says it all. There are many great amateurs now and there'll be many more in the future, but there'll never be another "Superham."

Jack Burnett

MPA

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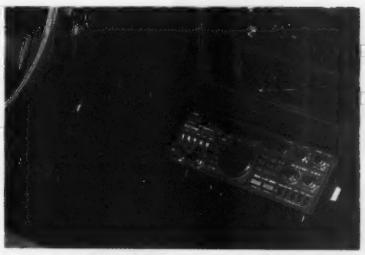

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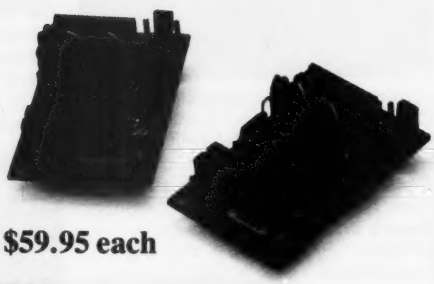

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EDITED BY PERRY DONHAM KW1O

Band New!

A NEW AMATEUR BAND opens for business on **June 22, 1985, at 0001 UTC!** The FCC has decided to allow hams early access to the 12-meter spectrum allocated during the last World Administrative Radio Conference. General-, Advanced-, and Extra-class ticket-holders may use 1500 Watts PEP from 24.890 to 24.990 MHz on a shared basis with Fixed Service users until July 1, 1989, when the band will become exclusively ours. Because of an existing IARU Region 2 resolution, the FCC has opted to specify formal subbands: 24.890 to 24.930 MHz is available for A1A and F1B emissions, and 24.930 to 24.990 MHz is available for A1A, F3E, G3E, A3C, A3F, F3C, and F3F. There are about 40 countries allowing hams to use this band right now. See you on 12!

160 Grows Up

THE FCC SMILED on amateurs in another area concerning the use of RTTY, FAX, and SSTV on 160 meters. Effective June 17, 1985, hams may use these modes on the entire band. In their final ruling on Docket 84-959, the Commission stated that "the present limitation restricting emission modes...is no longer necessary since that limitation was designed to protect the discontinued LORAN-A radionavigation system." However, the ruling also stresses that Docket 84-874, which addresses amateur use of 1900–2000 kHz, is still in motion, and that "no equities will accrue for investment in equipment which operates only in this band."

Arizona Splits

ARIZONA HAS ADOPTED the 20-kHz-split repeater band plan for 2 meters. No new 15-kHz-split requests will be coordinated, but new 20-kHz pairs will be assigned only when a written agreement is obtained from all of the repeaters that would be required to move. State coordinators are taking things slowly and the entire process is entirely voluntary.

RFI Battle

A CANADIAN AMATEUR is being sued for damages in a $35,000 RFI case. A neighbor of **Jack Ravenscroft VE3SD** claims that his microwave oven turns on and that his electronic organ's sound deteriorates whenever Jack fires up on 20 meters. There is a very real chance that an unsympathetic judge could rule in the plaintiff's favor, setting an ugly precedent for interference cases everywhere. The Ottawa Amateur Radio Club has set up the Jack Ravenscroft Defense Fund; if you would like to contribute to the cause, conatct OARC at Box 8873, Ottawa, Ontario K1G 3J2.

Happy Hams

THREE LUCKY PEOPLE are very glad that they stopped by the *73* booth at the Dayton Hamvention this year. Not only did they get to meet the wonderful folks who bring you *73* every month, they were winners in our special Dayton HT Giveaway! **Ken Hydeman K8SVM** of Dayton, Ohio, won a Yaesu FT-209RH, **Jean Gade** from Hot Springs, Arkansas, received a Kenwood TH-21AT, and **Don Cogley KA0CPY** of Omaha, Nebraska, walked away with an ICOM IC-02AT. Turn to the next page to see some of the thousands of sad people who *didn't* win a hand-held at Dayton.

October 'Fest

TWO GERMAN ASTRONAUTS will be carrying amateur radio aboard a Shuttle flight scheduled for October of this year. **Dr. Ernst Messerschmid DG2KM** and **Dr. Reinhard Furrer DD6CF** will be on board *Columbia* this fall during the first German-controlled Spacelab mission. The equipment, built by the Robert Bosch Company, provides four 2-meter receive channels and eight 70-cm 10-Watt transmit channels. Plans call for FM two-way QSOs whenever possible, and automatic recording of calls when Ernst and Reinhard are busy with flight-related duties. A 1-Watt 70-cm beacon will come in handy for determining if the Shuttle is in range of your station. "QRX" and the *73* RBBS at (603)-924-9809 will carry complete details of the operation, including frequencies, when they are announced.

The astronauts of Spacelab mission D1 (from left): Wubbo Ockels, Reinhard Furrer DD6CF, Ulf Merbold, and Ernst Messerschmid DG2KM.

Marti Me

AFTER A DELAY OF A YEAR AND A HALF, Radio Marti will begin operation with 14½ hours of Cuban programming each day. Part of the **Voice of America**, the Florida-based station will transmit news and entertainment to Cuba on the standard AM broadcast band, perhaps inviting retaliation by Cuban-based high-power jamming equipment. It would make 1150 kHz sound like 40 meters at night!

Shuttle Shot

THE LATEST WORD FROM NASA has Shuttle mission 51-F carrying **Tony England W8ORE** and **John-David Bartoe W4NYZ** lifting off on July 15th. Amateur operation during the first few days will consist of unattended SSTV on 145.55 MHz using a modified Robot 1200C scan converter. **Rick Sammis** of Robot Research says that the modifications include the Shuttle's mission logo stored in ROM and an automatic sequencer that will transmit frames using most of the popular slow-scan formats. The third day should bring opportunities for two-way QSOs, but most of the activity will occur on unannounced frequencies during scheduled contacts with clubs and youth groups. NASA has agreed to announce the status of the ham station at least one pass in advance: Listen for Shuttle ground communications that will be retransmitted by Goddard club station WA3NAN on 3.860, 7.185, and 14.295 MHz during the astronauts' activity period.

Hot Spot

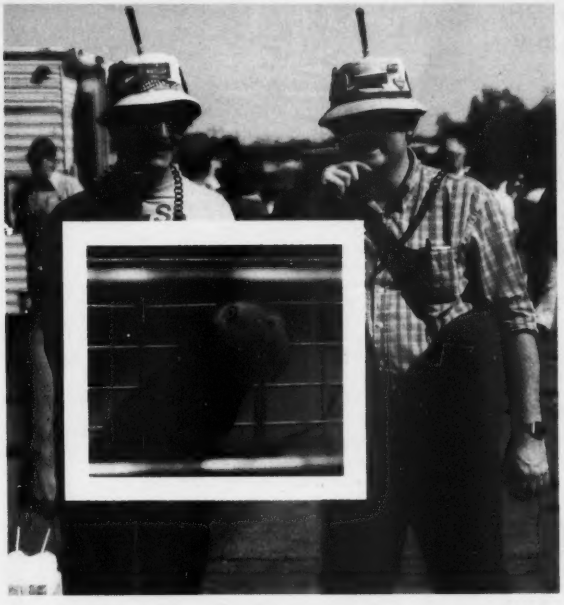
YOU CAN ALWAYS TELL when warm weather arrives in New Hampshire—with it come visitors to *73*! Recent guests included **Jim KF4OO** and his wife **Nancy**, who were up from Florida on a tour of the east coast. We always enjoy meeting the people who read the magazine; if you happen to be in Peterborough, be sure to drop by and say hello.

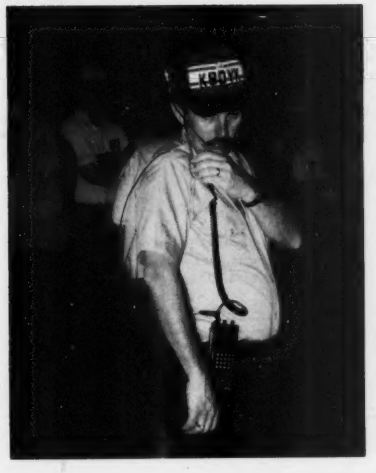
Merci

WE TIP OUR HAT this month to *The ARRL Letter*, the *W5YI Report*, the *CRRL News*, Ralf Beyer DJ3NW, and Paul Courson WA3VJB, all of whom contributed to "QRX" this month.

Faces of Dayton '85

Radio

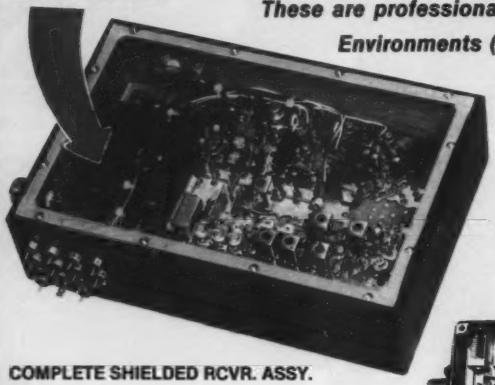




Spectrum Repeater/Link Boards & Sub-Assemblies

New FL-4 UHF Helical Resonators
Installed in Rcvr., or FL-4H Preselector Unit

These are professional "Commercial Grade" Units—Designed for Extreme Environments (–30 to 60° C.) All Equipment Assembled & Tested.



For 10M, 2M, 220 MHz, & 440 MHz

IMPROVED SCT410B TRANSMITTER ASSY.

SCT110 VHF Xmtr/Exciter Board

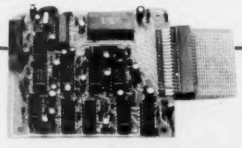
- 10 Wts. Output 100% Duty Cycle!
- Infinite VSWR proof
- True FM for exc. audio quality
- Designed specifically for continuous rptr service. Very low in "white noise."
- Spurious—-75 dB. Harmonics—60 dB
- With .0005% xtal.
- **BA-30 30 Wt. Amp board & Heat Sink,** 3 sec. L.P. filter & rel. pwr. sensor.
- **BA75 75 Wt. unit also available.**

SCT110 Transmitter Assembly

- *SCT110 mounted in shielded housing*
- Same as used on SCR 1000 & 2000
- Completely assmbld. w/F.T. caps, SO239 conn.
- 10, 30, or 75 Wt. unit.

SCT 410B UHF Transmitter Bd. or Assy.

- Similar to SCT110, 10 Wts. nom.
- ***Now includes "on board" proportional Xtal Osc./Oven circuitry for very high stability!***
- **BA-40 40W. UHF AMP. BD. & HEAT SINK**



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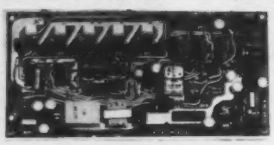
- Sens. 0.25 μV/12dB SINAD typ.
- Sel. -6dB @ ± 6.5 KHz. -130dB @ ± 30KHz. (8 Pole Crystal + 4 Pole Ceramic Fltrs.
- 'S Meter', Discriminator & Deviation Mtr. Outputs!
- Exc. audio quality! Fast squelch! w/0.0005% Crystal. *("Super Sharp" IF Fltr. also avail.)*

Complete Receiver Assemblies

- **Rcvr. Bd. mounted in shielded housing.**
- Completely asmbld & tested, w/F.T. caps, SO239 conn.
- **As used in the SCR1000. Ready to drop into your system!**
- **UHF Rcvr. Assy. Now Available w/Super Sharp FL-4 Helical Resonators. Greatly reduces IM & "out of band" interference!**



SCAP Autopatch Board

- Provides all basic autopatch functions
- Secure 3 Digit Access; 1 Aux On-Off function, Audio AGC; Built-in timers; etc. Beautiful Audio!
- 0/1 inhibit bd. also available
- Write/call for details and a data sheet

RPCM Board

- Used w/SCAP board to provide "Reverse Patch" and Land Line Control of Repeater
- Includes land line "answering" circuitry

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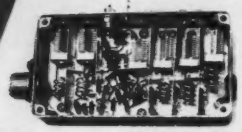
- Gas Discharge Tube shunts phone line surges to ground
- Handles up to 40,000 Amps!
- The Best device available to protect Autopatch equipment from lightning damge. $17.00 + S/H.



FL-6

FL6 Rcvr. Front-End Preselector

- 6 Hi Q Resonators with Lo-Noise Transistor Amp (2M or 220 MHz).
- **Provides tremendous rejection of "out-of-band" signals w/out the usual loss!** Can often be used instead of large expensive cavity filters.
- Extremely helpful at sites with many nearby VHF transmittors to "filter-out" these out-of-band signals.

NEW

SCR 500 VHF/UHF LINK/CONTROL RCVR.

- SCR200A or SCR450A rack mounted
- Available with or without meters and power supply

NEW

ID250A CW ID & Audio Mixer Board

- Improved! Now includes "audio mute" circuit and "Emergency Power" ID option.
- 4 input AF Mixer & Local Mic. amp.
- PROM memory—250 bits/channel.
- Up to 4 different ID channels!
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- Complete solid state control for rptr Cor, "Hang" Timer, "Time-Out" Timer, TX Shutdown/Reset, etc.
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Repeater Tone & Control Bds.

For SCR1000/4000 & CTC100/ID250 only

- **TMR-1 "Kerchunker Killer" or "Time Out Warning Tone" Bd.**
- **TRA-1 "Courtesy Tone Beeper" Bd.**
- **PSM-1 Power Supply Mod Kit replaces Darlington pass transistor in older SCR1000/4000s.**

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TTC300 TOUCH TONE CONTROLLER

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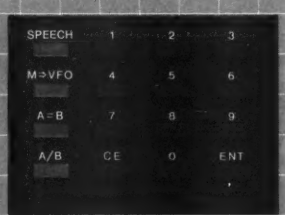
ICOM HF Receiver

IC-R71A

The World Class World Receiver

ICOM introduces the IC-R71A 100KHz to 30MHz superior-grade general coverage HF receiver with innovative features including keyboard frequency entry and wireless remote control (optional).

This easy-to-use and versatile receiver is ideal for anyone wanting to listen in to worldwide communications. With 32 programmable memory channels, SSB/AM/RTTY/CW/FM (opt.), dual VFO's, scanning, selectable AGC and noise blanker, the IC-R71A's versatility is unmatched by any other commercial grade unit in its price range.



Keyboard Entry. ICOM introduces a unique feature to shortwave receivers...direct keyboard entry for simplified operation. Precise frequencies can be easily selected by pushing the digit keys in sequence of frequency. The frequency will be automatically entered without changing the main tuning control.

Superior Receiver Performance. Passband tuning, wide dynamic range (100dB), a deep IF notch filter, adjustable AGC (Automatic Gain Control) and a noise blanker provide easy-to-adjust clear reception even in the presence of strong interference or high noise levels. A preamplifier allows improved reception of weak signals.

32 Tunable Memories. Thirty-two tunable memories, more than any other general coverage receiver on the market, offer instant recall of your favorite frequencies. Each memory stores frequency, VFO and operating mode, and is backed by an internal lithium memory battery.

Options. FM, RC-11 wireless remote controller, synthesized voice frequency readout, IC-CK70 DC adapter for 12 volt operation, MB-12 mobile mounting bracket, two CW filters, FL32-500Hz and FL63-250Hz, and high-grade 455KHz crystal filter, FL44A.

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All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. R71A1084

John S. Wilcox KS4B
640 Breton Bay Drive
Leonardtown MD 20650

ICOM's Extended Play

Ten minutes with a Phillips screwdriver gives your IC-751 transmit capability from .1 to 30 MHz!

In its short lifetime, the ICOM IC-751 competition-grade HF transceiver has truly become a standard of comparison. The excellent quad-conversion receiver coupled with the most up-to-date digital features has made it the transceiver to be reckoned with.

One of the features that enhances the IC-751 and makes it a superlative bargain for maritime, commercial, and MARS operators is the all-mode general-coverage capability. This feature allows AM, FM, CW, RTTY, and SSB reception from 100 kHz to 30 MHz—all standard. The transceiver is supplied with transmit capability limited to the nine WARC amateur bands but can be modified easily to transmit virtually throughout the spectrum. This simple modification requires the removal of one pin from a plug on the rf printed circuit board and is immediately reversible with no soldering required. With only a Phillips screwdriver needed as a tool for this modification, it's pretty hard to beat!

Remove the top cover of the IC-751. Twelve Phillips-head screws retain this cover. (It would be smart at this point, if you haven't already, to disconnect the power from the transceiver.) Locate J2 on the rf PCB (see Fig. 1). Note the bottom-most pin (pin 1) on the plug.

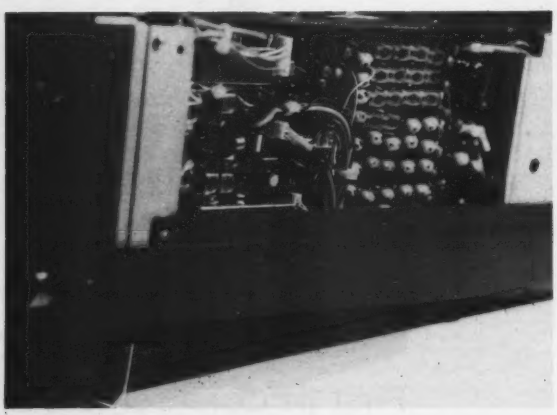

Fig. 1. Arrow points to the connector.

This is the mute-signal line and is the one you'll be removing. On my transceiver, the wire color to this pin is black.

Carefully work the plug out of J2 and turn it so that the small access holes in the side of the plug are visible to you (see Fig. 2). Insert a small pointed tool or pin into the access hole for pin 1 and depress the pin retainer. Grip the wire and carefully pull the pin back out of the plug. Align and reinsert the plug into J2. Tape the loose pin and dress the wire so it can't be pinched when the top cover is replaced. Make sure that no other wires or cables have moved out of place on the rf board or on the top main board so that they could be pinched. This action might save you numerous hours of heartache while your brand-new IC-751 is in Bellevue, Washington, getting repaired!

Following the modification, all functions remain the same when operating the transceiver. Notice that the general-coverage (GENE) readout still lights in the display window when that mode is energized. The only difference is that now you are able to transmit anywhere—in or out of the amateur bands. The GENE flag must now be looked upon as a warning indicator to save you more heartache from the pink slip you could get for transmitting out of authorized bands.

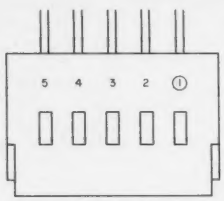

Fig. 2.

For the squeamish or more forgetful hams who want the full transmit capability but not the responsibility of transmitting where they shouldn't, the mute line can easily be wired to two spare pins on the back-panel accessory socket and a temporary jumper placed across the socket pins. Pins 14 through 24 of the accessory socket are available for this purpose.

This simple change makes ICOM's best even better. Normal maritime, commercial, and MARS operation is now possible as is the peace of mind you gain by having full HF transceive capability for possible emergency communication conditions. ICOM can be congratulated for providing a real thoroughbred to the communications world. ■

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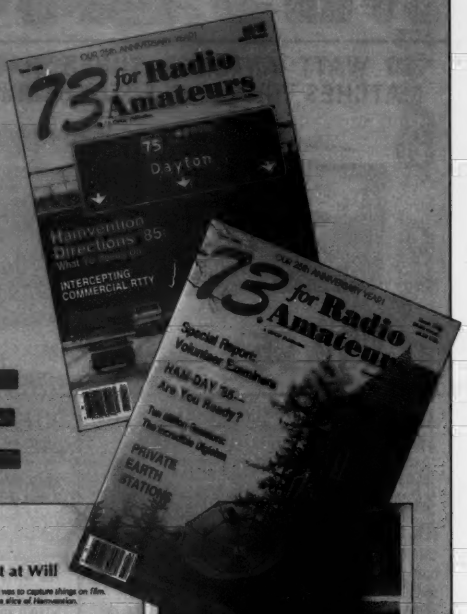

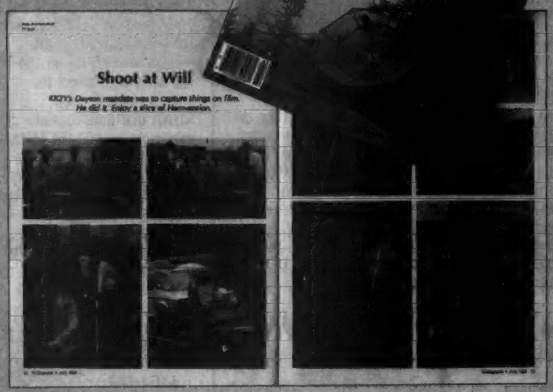

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September 1984
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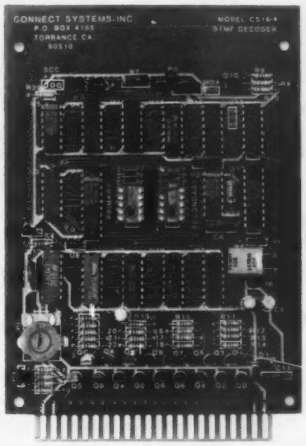

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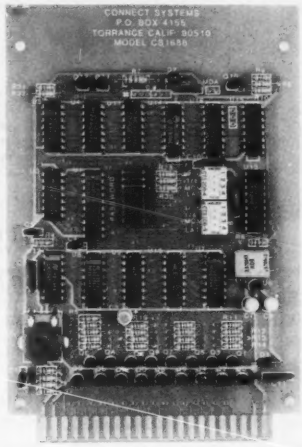

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3.	8 MOMENTARY	and	8 LATCHED
4.	8 MOMENTARY	and	1 OF 8 SELECT
5.	1 OF 8 SELECT	and	8 MOMENTARY
6.	1 OF 8 SELECT	and	1 OF 8 SELECT
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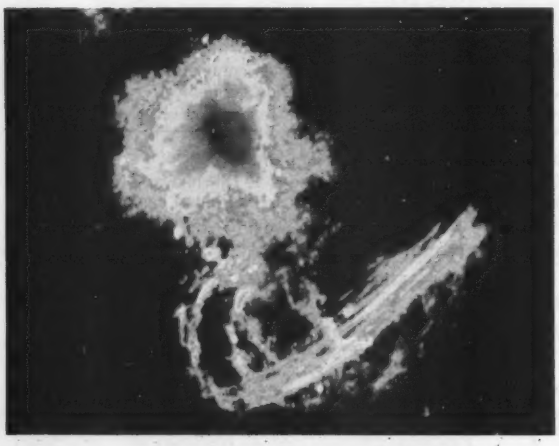
The Very Large Array in New Mexico is the world's most advanced radio astronomy observatory. This observatory, which looks like a huge Y when seen from the air, is located near Socorro on the Plains of St. Augustin. Along the outline of the Y, 27 large reflecting antennas can be seen in a pattern which may change from week to week.

The VLA (Very Large Array) radio observatory was constructed by the National Radio Astronomy Observatory (NRAO). NRAO, which is funded by the National Science Foundation, is also responsible for the daily operation of the Very Large Array.

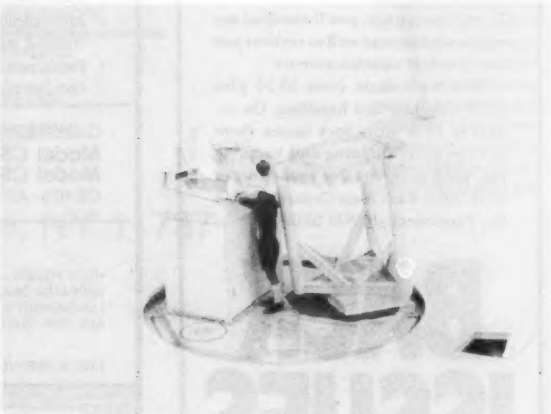
NRAO was formed in 1956 to develop the best possible radio telescopes and to make these available to scientists from all countries. The first NRAO observatory was constructed near Green Bank in West Virginia, a site which was chosen because nearby mountains shield the observatory from most types of man-made radio noise. NRAO also constructed a millimeter-wave radio observatory at the top of Kitt Peak in Arizona. Millimeter radio waves are attenuated by the atmosphere, so this observatory had to be located at a high altitude to reduce the problem of atmospheric attenuation.

The St. Augustin Plains in New Mexico were selected by the NRAO as the site for its most advanced observatory for several reasons. The area is sparsely populated,

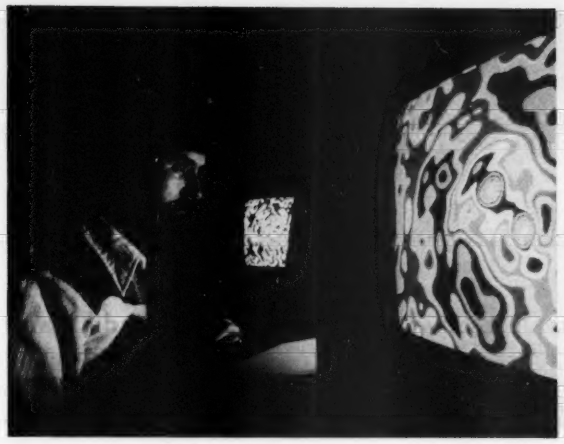
Photos: the National Radio Astronomy Observatory, operated by Associated Universities, Inc., under contract with the National Science Foundation.



The galactic center of the Milky Way. The powerful radio sources in this VLA image may be caused by a huge black hole.



Technician inspecting the receivers and feedhorns on a VLA antenna.



Most of the observations from the VLA are processed into radio images or maps. The color graphics are produced by VLA computers. Colors are used to depict varying intensities in the radio images.

Installation of a VLA waveguide. These two-inch copper tubes serve as two-way communication channels. Control signals flow from the control building to the antennas in one direction, and the data from the observations flow in the opposite direction.

and there is little nearby industry, so that little man-made radio noise could interfere with the observatory. The plains are extremely level, so the railroad-type rails which are used to transport the antennas from one location to another could follow straight lines across the facility. Reception of radio waves on the shortest wavelengths which the observatory can use is subject to atmospheric attenuation. As the St. Augustin Plains are located at an altitude of about 7000 feet above sea level, the atmospheric attenuation is low.

The electromagnetic spectrum ranges from the extremely short gamma rays to long radio waves. All parts of this spectrum are of interest to astronomers. Only visible light, radio waves, and portions of the ultraviolet and infrared wavelengths can be observed from the ground as the atmosphere shields us from the rest of the electromagnetic spectrum.

The resolution which a telescope can give of a distant object depends upon the wavelength through which the telescope is observing that object and the diameter of the telescope. Because radio waves are much longer than the waves of visible light, a radio telescope must be much larger than an optical telescope to achieve the same ability to resolve distant objects. A radio telescope would have to be several miles in diameter in order to equal the largest optical telescopes in their ability to show fine details in an object.

During the 1950s, astronomers in England and the United States developed a more practical way to improve the resolution of radio telescopes. This method is called interferometry. Through interferometry, two or more radio telescopes are combined in observing the same object. With this technology, a resolution may be achieved which would approach that of a single telescope whose diameter is equal to the distance between the combined radio telescopes. Interferometry requires extremely accurate clocks which are used to measure the time of arrival of a signal at each of the two or more radio telescopes that are participating in an observation.

The VLA was completed in 1980 after seven years of construction. There are 27 identical parabolic reflector antennas in the array. The antennas are mounted on foundations that are movable along the Y-shaped system of railroad-type rails which covers the site.

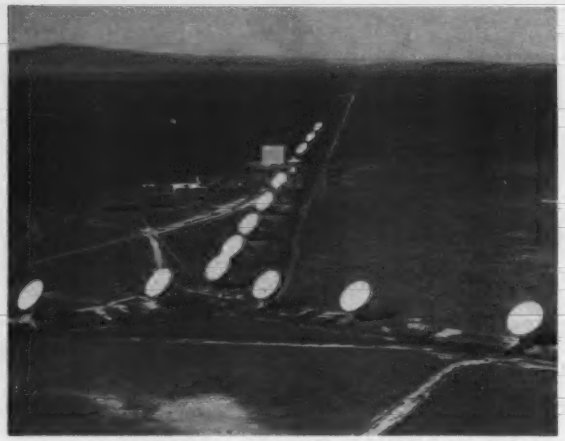
Each VLA antenna has a diameter of 82 feet. The antennas are working in the Cassegrain configuration. In this configuration, the main parabolic reflector reflects the incoming signals to a secondary reflector at the focus of the parabola. The receiving equipment which is located at the base of the main reflector receives the signals from the secondary reflector.

The receivers in the VLA are cooled to 18 degrees above absolute zero through refrigerators that are using liquid helium. All electronic components produce some internal electronic noise. The internal noise level is proportional to the temperature of the components. This noise is minimized by the refrigeration system in each VLA receiver. At room temperature, the internal noise in the components would overwhelm many of the weak signals that are being received from space.

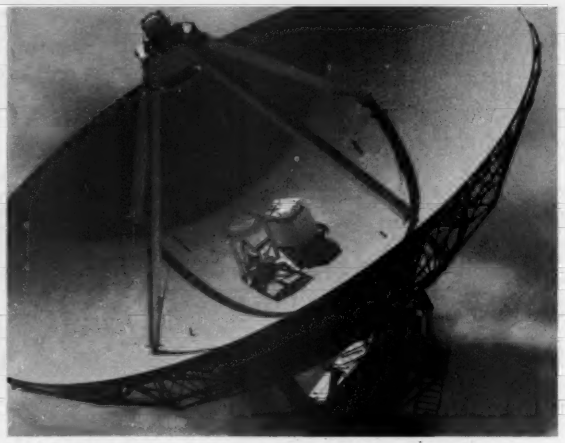
The aiming of each antenna in the VLA is controlled by a computer in the observatory's control building. The antennas can therefore follow an object as it moves across the sky due to the rotation of Earth with a very high degree of accuracy.

Each antenna in the VLA is connected to the control building through two-inch waveguides. The waveguides are part of a two-way communications system, as these are transporting the received signals from the antennas in one direction and the control signals from the central computer to the antennas in the other direction.

The antennas in the VLA are not self-propelled. A special rail transporter is used to move the antennas in the VLA from one site along the Y-shaped pattern to another. Each antenna with foundation weighs 235 tons. The transporter supplies the antennas with electrical power when they are being moved, so the receivers are cooled also during transportation. This is necessary in order to maintain the stability of the electronic components in the receivers. The transporter can usually move an antenna from one site to another in two hours. It takes a



Aerial view of the VLA. The large building in the background is the assembly building, which now is being used to repair and maintain the antennas. The other buildings in the photograph contain laboratories, offices, and computer equipment.



Close-up of one of the 27 VLA antennas.

week to reconfigure the entire antenna system in the VLA.

The antennas are repaired in a large building which initially was used to assemble the antennas on their foundations. The transporter is used to move each antenna to the assembly building for scheduled maintenance and for repairs. Complex electrical motors are used to move each antenna in the horizontal and vertical directions, and these also need regular maintenance in the assembly building.

The VLA antennas can be positioned in four main configurations. In the most dense configuration, all 27 antennas are crowded inside an area with a diameter of only 4000 feet. The most extensive configuration is one in which the antennas are located in a pattern across the entire 21-mile span of the observatory. By combining the four configurations, one can achieve an effect which is similar to that of a zoom lens. In the most dense configuration, the VLA can observe a large area of the sky, but with little detail. In the most extended configuration, it can study a small area of the sky in great detail.

The resolving power of the VLA exceeds that of any other radio observatory. Only in sensitivity is it exceeded by another radio observatory, the Arecibo observatory in Puerto Rico (see "Stare-Way to Heaven," *73*, August, 1984). The sensitivity of a radio observatory to weak signals from space is related to its antenna area. The VLA array has a sensitivity which would equal that of a single antenna, 430 feet in diameter. The Arecibo observatory has a diameter of 1000 feet.

The control building at the VLA contains computers that analyze the signals from each antenna. These computers make millions of calculations each second in order to enable the observing scientists to form an image of the object which is being observed, or to produce the radio spectrum of the emissions from the object. The data also can be recorded on magnetic tape. In this way, an astronomer may not even have to be present at the observatory when his observations are made. The image of an object can be constructed days or even weeks after an observation was made, through use of magnetic tape.

Most of the observations at the VLA are processed into radio images that resemble photographs. The resulting image presents the object as if one had a camera which was sensitive to radio waves instead of light waves. Colors are used to distinguish different levels of intensity in the received radio image. The final product of the VLA is usually an article in a scientific journal or publication describing new discoveries.

The rotation of Earth is utilized as a tool by the VLA. As Earth rotates, the space between the Y-shaped arms of the observatory is gradually being filled in. After a few hours of observation, data has been assembled, almost as if the array consisted of a solid reflector measuring 21 miles from one end to the other. The resolution which can be achieved through this technique is superior even to that of the largest optical telescopes.

Much of the sensitive receiving equipment and control equipment which the VLA uses is developed in laboratories which are part of the VLA facility. A number of improvements in the low-temperature refrigeration systems have also been developed by these laboratories.

Like other radio telescopes, the VLA is capable of observing the sky in broad daylight. The observatory is therefore in use around the clock. Astronomers from all over the world may compete for observing time at the VLA observatory. Allocation of observing time at the VLA is usually based on an evaluation of the scientific merit of each proposed set of observations.

Space is filled with magnetic fields of varying intensities. Whenever an electron moves in a magnetic field, its movement is altered. Whenever an electron changes its speed or direction, an electromagnetic wave is emitted, often at radio wavelengths. The VLA and other radio observatories are therefore able to collect a great deal of information about the magnetic fields which may play an important role in the formation of stars and galaxies.

A lot of information can be obtained on a distant object through its rf spectrum. Many elements and chemicals have emissions which may be identified in this spectrum, and movements and temperatures in the object result in Doppler shifts and widening of the spectral lines. Through the spectrum, an astronomer can therefore determine much of the chemical composition, movement, and temperature of a distant object.

The VLA is often used to

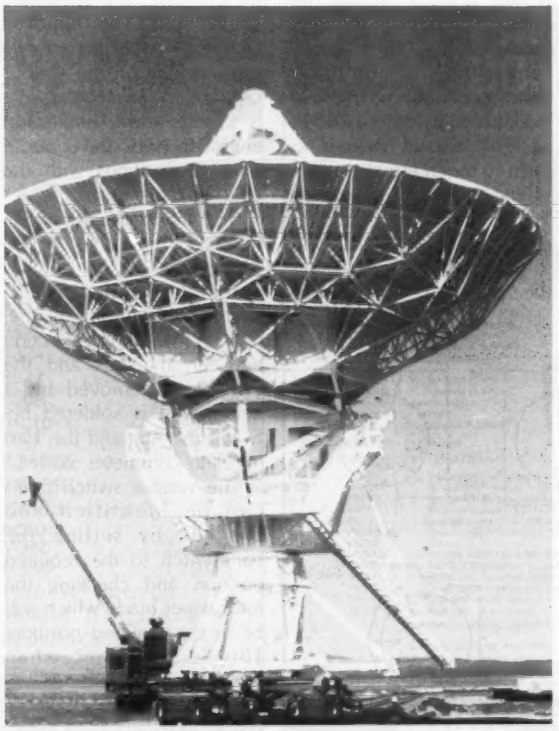
study the centers of distant and nearby galaxies. Even the center of our own galaxy can be observed by the VLA. The light from the central region of the Milky Way is obscured from us by dust and gas which lies between the solar system and the center of our galaxy. The longer radio waves are able to penetrate all this dust and gas, however, so that they can produce radio images of our galactic center. These images indicate that there is a lot of energy being radiated from violent processes near the center of our galaxy. Images of other galaxies show similar powerful emissions from the center. Many astronomers believe that these observations can be explained only by assuming that there are huge black holes near the centers of the Milky Way and other galaxies.

Galaxies which emit much more energy in the radio wavelengths than normal galaxies are called radio galaxies. Many radio galaxies have huge radio lobes that extend far beyond the visible limits of the galaxy. These radio lobes seem to originate near the center of these galaxies and appear to consist of charged particles that are streaming away from the center at velocities that approach the speed of light. Scientists at the VLA have devoted a lot of observing time to the study of radio galaxies. One of the nearest of these galaxies is called Centaurus A. If the radio lobes of Centaurus A could be seen in visible light, these would be one of the largest objects in the sky. The radio lobes of Centaurus A cover a larger area of the sky than the full moon.

The remants of supernovas, or stars that exploded, are among the strongest emitters of radio waves in the Milky Way. A supernova explosion leaves a large expanding shell of hot gases and dust. At the center of this shell, a rapidly rotating neutron star can usually be found. The VLA has been used both for the mapping of many supernova shells in the Milky Way and in the search for rotating neutron stars. A rotating neutron star will appear as radio pulses that are repeated with such a regularity that these cosmic lighthouses could be used to measure time.

Sunrise at the VLA.

Some of the brightest radio emitters in the universe are also among the most distant objects in the sky. These objects are called quasars and are believed to be located near the center of extremely distant galaxies. The radio waves from most of these sources have spent billions of years in their journey towards us. The VLA has participated in many research programs on quasars. The long time which the radio waves from the quasars have spent underway means that when it is observing a quasar, the observatory is actually looking at an object as it appeared billions of years ago.



VLA antenna on the rail transporter which is used to move the antennas from one site to another.

Even greater resolution of distant objects than that which can be achieved with the VLA can be made possible by combining the observations from several observatories across a continent. This is routinely being done by a network of radio observatories which includes participants on both the east and west coasts of the United States. The VLA itself participates in many of these studies. This type of observation, which is called Very Large Baseline Interferometry, may even involve observatories on other continents, such as in Europe and South America. If funding for the project can be obtained from the US Congress, construction of a Very Large Baseline Interferometry Array will start in a few years. This will consist of 10 VLA-type antennas located at sites in Hawaii, Puerto Rico, and across the continental United States. The movement of each of the 10 separate antennas in this array will be controlled by a master computer in Socorro. This continent-wide array will thus act as an extension of the VLA and will allow us to observe many interesting objects in the sky in an amazing degree of detail.

The Very Large Array welcomes visitors to the observatory. The VLA facility includes a visitor center which is open from 8:00 am until sunset every day. The visitor center contains displays on radio astronomy and a detailed description of the array and how it is operated. A self-guided tour is also available, so that a visitor may have access to many of the interesting facilities of the observatory. ■

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WARC for the FT-101E

Here's how to join the fun on our new 12-meter band. And you'll be ready for 18 MHz, too!

The FT-101E series of transceivers has no provision for the new bands, and since I am well satisfied with the operation of the FT-101E, I did not feel inclined towards the expense of changing to one of the later models which includes these new bands.

A thorough study of the schematic and the innards of the transceiver revealed that, with careful working and not rushing things, the modifications required would be relatively simple. (By the way, the handbook states for the "Aux" position of the bandswitch: "any 500-kHz coverage between 14.5 and 28.0 MHz." Don't believe it; it works FB for 24.5, but certainly not for 18. I know; I tried it.)

After consideration, it was decided to forfeit band 10D, as 29.5–29.7 MHz is never used by me and this position was used for the 24.5-MHz band. Simply plug in a 30.520-MHz crystal in place of the existing 35.52-MHz crystal and retune TC23 to obtain the correct output at the test point on PB1181 (rf unit), namely 0.3 V rms on the rf voltmeter, and the rig will work perfectly on the 24.89–24.99-MHz band. There is no need to touch the alignment of the rf and driver stages TCs, as these are tied together for the 10m bands, and the inductance variation in the "preselect" tuning takes care of the lower frequency quite adequately.

The 18-MHz band is put into the Aux position and requires a little work on the various circuits in addition to plugging in a 24.02-MHz crystal and tuning TC24 for the required 0.3-V-rms output to PB1181. Fortunately, all the work is done at the bandswitch, although the chassis must be removed from the cabinet to facilitate working on the various switch sections. The chassis is upside down, and references to top and bottom refer to positions with the chassis so placed.

In making the modifications, each switch section should be worked on and completed separately. I started with the easy one, i.e., SW1M. The connection between the Aux and the 10m lugs is removed and a heavy wire is soldered between the Aux and the 15m lug. This completes SW1M.

The various switch poles can be identified and checked by setting the bandswitch to the required position and checking the rotor wiper blade which will be in the required position. This is important when working on the other switch wafers as there is very little space, and without a good light spotted on the wafer being worked on, it is almost impossible to see anything. In addition, a soldering iron with a long, thin bit should be used because of the lack of space for working.

I next tackled SW1G. It will be seen from the schematic that there are no connections to the Aux and 10m switch lugs so that the only thing to do is to connect the Aux lug to the 15m lug. This is a little awkward, and the reason for the long, thin bit on the soldering iron will be obvious. Note that SW1G is the 8th wafer from the front, not the 7th as would be expected. It is in the driver plate compartment.

SW1E is the most difficult and awkward; this is the 5th wafer from the front. The first thing is to break the connection from the Aux lug to the 10m lugs. As this lug is on the bottom of the switch, ordinary cutters cannot be used: There is only about 3/8" working space. I overcame the difficulty by using a very thin round file, and slowly filing through the connecting wire. This requires a great deal of care and patience. When this was completed, the short pieces of wire that remained were bent out of the way. From the Aux lug, a white wire goes to TC5; this connection to TC5 is removed at the trimmer PCB, and the white

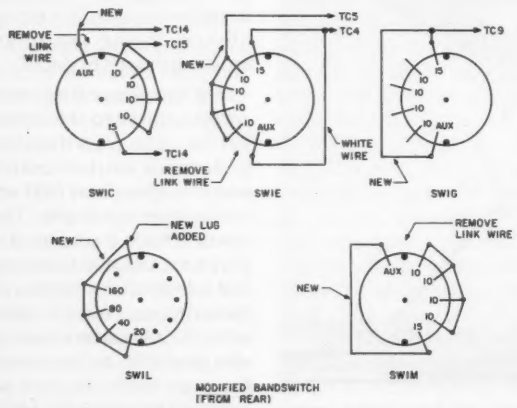

Fig. 1. Modified bandswitch (from rear).

wire is used to connect the Aux lug to the 15m lug. A new wire is soldered to the 10m lugs at the top of the switch wafer and then connected to TC5. The 15m lug is already connected to TC4 and needs no further attention.

The modification of SW1C, 3rd wafer from the front, proved easier than at first expected. I started by removing the connection between the Aux and 10m lugs positioned on top of the switch wafer. A wire is soldered to the Aux lug and fed over and soldered to TC14 (15m trimmer); this connection is made on top of the trimmer PCB.

At this point, I put the whole rig together again and fired it up to check tuning and performance into a dummy load. Everything was FB on all bands except 18 MHz. There was not enough capacity in the one section of VC2, which is used on 15 MHz and above, to load the output satisfactorily. So, the rig was opened up again as it was obvious that more capacity had to be introduced in the loading for the 18-MHz band.

After much thought and study, I decided to modify SW1L by adding a new contact lug at the Aux position on top of the wafer. A lug was removed from an unused spare rotary switch that was on hand; this was done by carefully drilling it out and removing the rivet holding it. This lug was then mounted in position on SW1L using a very small bolt and nut, and a stiff wire bridged it over to the 160m lug on the switch. (A spot of solder on the nut and bolt prevents movement.) The lug must be carefully positioned and set so that the rotor wiper arm makes a good clean contact and moves smoothly.

The rig was now reassembled and tested into the dummy. All bands, including 18 MHz, were now capable of being tuned normally. The measured outputs into the dummy (CW tested) were 110 Watts on 24.5 and 28 MHz and 125 Watts on 18 MHz and other bands.

Band	Preselect	Plate	Load
28	9.2–9.6	8.7–9.1	3.0
24.5	8.0	7.5	2.6
21	8.8	7.9	2.0
18	7.3	6.9	2.0
14	7.0	7.0	2.0
7(low)	5.1	4.5	3.0
3.5(low)	3.2	2.3	2.0

Table 1. Dial readings.

As these bands have been available in ZS for over a year, an air test using a very rough and ready dipole, badly installed, produced two TR8 stations on the first CQ call.

As a guide, the dial readings given in Table 1 for the various controls are as recorded by the writer. Different installations will produce variations.

Upon consideration, and with a good deal of hindsight, it would seem that SW1L need not be modified. The addition of a 200-pF (1,000-V) capacitor in parallel with VC2 (the front section which is in circuit on all bands) would provide ample capacitance for loading on 18 MHz and would only cause the tuning of the other bands to be moved towards the center of the load dial.

I have ignored the modification to put the FT-101E series on 10 MHz, first because it was admirably covered by WB9DDF in the November, 1983, issue of *73*, and second that band does not interest me. ■

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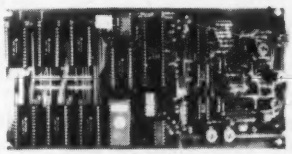

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In designing a downlink station for AMSAT-OSCAR 10 satellite reception, the main goal is to develop a setup where system noise is as low as possible compared to the extremely weak signals coming from the satellite. Sounds simple enough, but it is important to be able to characterize the performance of the system as it is being assembled so that when you are finished, you can at least rest assured that you have done the best you possibly could.

I have read in several publications that, at 146 MHz, system noise will be limited by the inherent noise in the downlink electronics. If and when this is the case, the optimum downlink is the one with the lowest possible noise figure. My experience has been, however, that system noise is often limited by external or atmospheric noise (that which is picked up by the antenna) and not by the noise produced within the electronics. When *this* is the case, no improvement will be gained by further reduction of the noise from the equipment.

This article will describe techniques for characterizing the internal and external sources of noise affecting an OSCAR Phase III satellite downlink station and will assume the availability of only an ac voltmeter and an rf 50-Ohm termination as test equipment. It is written with the 146-MHz downlink signal of AO-10 in mind, but the techniques could be applied at other frequencies as well.

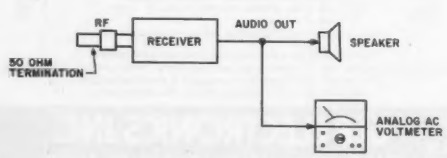

Fig. 1. Basic noise test setup.

Terms

I'll be using some terms which may not be familiar to all readers. By "intrinsic noise" I mean all noise sources inherent to the electronics of the receiving system, while "extrinsic noise" refers to all noise sources external to the receiving system (i.e., picked up by the antenna), whether they be man-made or natural.

"Noise figure" is a figure of merit for an amplifier or receiving system. It is expressed in decibels (dB) and the lower the number, the better. A typical mediocre noise figure at 146 MHz is 4 dB, while a really good one would be 0.5 dB.

"System noise floor" refers to the baseline audio noise output of a receive system when the antenna is connected and no signals are present. It represents the combined effects of both intrinsic and extrinsic noise sources and is the reference level for system signal-to-noise measurements.

Test Signal Source

To make noise measurements on our system we need a very weak "signal" source. It turns out that most of the time the noise simply picked up by the antenna will be an adequate signal for our measurements. It may be a little hard at first to think of noise as signal, but in this case it will work just fine.

The goal is to develop your receiving system so that its intrinsic noise is less than that coming from the antenna naturally, so using the antenna noise as a source in doing our measurements is very logical and effective.

If you *cannot* hear any increase in output noise from your system when connecting an external antenna (compared to the noise output with a 50-Ohm termination at the rf input), then your intrinsic noise already dominates your signal-to-noise ratio and you may wish to start taking steps to reduce the intrinsic noise of your system (discussed later). In this case, since the antenna noise is not strong enough to hear, you will need to use a simple diode

noise generator (see the *ARRL Handbook*, among other sources) as a noise source for the measurements described below.

Noise Measurements

Fig. 1 shows the equipment configuration for making noise measurements with simple equipment. We will not have the capability to establish an absolute noise figure for our system (we do *not* assume the availability of a calibrated noise source or a true noise figure meter), but we really don't need that anyway. We are really just interested in *optimizing* our system for minimum intrinsic noise, which can be done adequately with simple equipment.

The "receiver" may be either a true 2-meter receiver or a 2-meter downconverter in front of an HF receiver. For this discussion, the distinction is unimportant. The audio output is routed to a speaker (or headhones) as well as to a high-impedance audio (ac) voltmeter. The noise levels to be measured will probably vary somewhat, so an analog meter will be best for "eyeball averaging" readings when necessary.

The voltmeter provides a very good way to obtain an averaged reading of the noise levels. The speaker is used to monitor the audio to ensure that we always are dealing with just random noise and not intermodulation products or other spurious signals which might show up at times.

The basic procedure is quite simple. With the rf input terminated with a 50-Ohm termination, fix the rf gain full open with avc disabled and adjust the af gain of the receiver for a level which produces a 10–20% meter deflection on the voltmeter. This establishes the reference noise level.

(You may notice that your receiving system is quieter with nothing at all connected to its rf input than it is when its input is terminated in the proper characteristic impedance, but the unterminated case is an unrealistic operating condition and is not of any use to us.)

Then, after changes are made (perhaps just connecting the antenna), note the new audio output level that is obtained without changing any of the receiver gain controls. The ratio of these two voltages provides a direct measurement of the signal-to-noise ratio (actually the (S+N)/N ratio) for the system under test. We will be interested in making this type of measurement under a variety of conditions.

We will always want to deal in decibel ratios. If you happen to have a meter with a scale calibrated in dB, you have it easy. If not, you may use a pocket calculator to apply the formula $dB = 20 \log_{10}(V_1/V_2)$, where V_1 and V_2 are the two voltages being compared.

Characterizing Intrinsic and Extrinsic Noise

The first item of interest is to compare the extrinsic noise to the intrinsic noise. We use the setup shown in Fig. 2, where we assume that a complete downlink station has been assembled. At the point where the feedline connects to the receiver, we also prepare a 50-Ohm termination plug (preferably shielded). For the moment, we assume nothing about the quality of the receiving system or its intrinsic noise.

The procedure is to install the 50-Ohm termination at the receiver's rf input, adjust the audio level to a 10–20% deflection voltmeter reading (with the rf gain at maximum and avc disabled), and make note of this level. Then remove the termination and connect the antenna and feedline. One of two things will happen: Either the noise level will increase (indicating that the extrinsic noise level is greater than or equal to the system intrinsic noise) or the noise level will not change (indicating that the extrinsic noise level is negligible when compared to the system intrinsic noise).

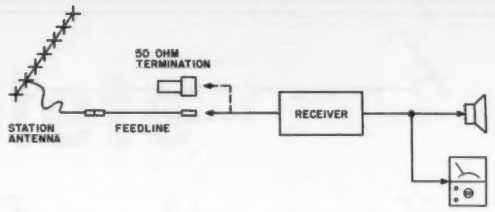

Fig. 2. Characterization of intrinsic and extrinsic noise.

In the first case, you need do nothing further to decrease the noise figure of your receiving system. The output noise level is already being dominated by the extrinsic, atmospheric noise, and lowering the intrinsic noise of the equipment will have no noticeable effect on the output signal-to-noise ratio.

In the second case, the overall system noise floor *is* being dominated by the intrinsic noise of the equipment and if you can take steps to decrease this, you can decrease your overall system noise level and improve your output signal-to-noise ratio. This is the more desirable situation, since it allows you to *do* something to improve system performance. Once you reach the level of the extrinsic noise in your location, however, you can improve things no further—unless you can first do something to reduce the extrinsic noise at your antenna.

Reducing Intrinsic Noise

If intrinsic noise is dominating your system, do what you can to reduce it. Beyond obvious problems like hum and noisy power supplies, however, you quickly get into a "black art" area where creativity, experience, and patience are the tools used to tune a receiving system for minimum intrinsic noise. With the exception of simply adding a preamp, a discussion of noise reduction techniques is beyond the scope of this article. If you want to get into this area, my advice would be to find a wise local expert and enlist his aid.

On the other hand, a relatively easy route to a quieter receive system is to add a high-quality preamplifier in front of it. Since the intrinsic noise of a receiving system is primarily determined by the characteristics of its first few stages, adding a state-of-the-art, low-noise, high-gain preamp is one of the easiest and most effective means of reducing intrinsic noise.

A good preamp produces lots of gain, typically 15–25 dB, while introducing very little additional noise; the gain (and noise generation) of the rest of the receive system can therefore be greatly reduced, with the result that the audio output signal-to-noise ratio is improved.

Fig. 3 shows some typical equipment configurations. If we assume an initial configuration something like that in Fig. 3(a), then we have the option of going to a configuration like that in Fig. 3(b) or 3(c) to reduce intrinsic noise. (Where we assume that the preamp is one with a better noise figure than the existing front end of the receiver.)

I recommend that you first try the configuration in Fig. 3(b), and after installing the preamp, again check the extrinsic noise. Remember that we started with a situation where the intrinsic noise was dominant (negligible increase in output noise level observed when the antenna was connected), but now you should have reduced the intrinsic noise considerably by installing the preamp; you need to see

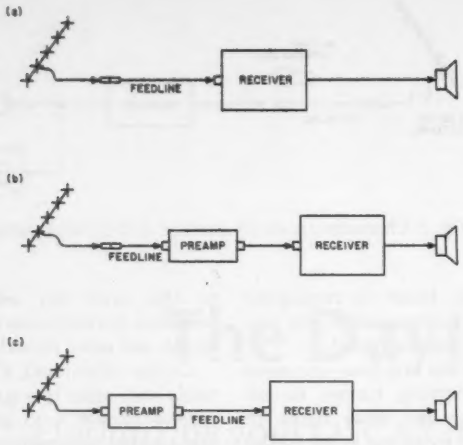

Fig. 3. System configurations.

how the intrinsic noise and extrinsic noise compare now.

If you find that the system noise floor is now being dominated by the extrinsic noise, you may stop, since any further reduction in intrinsic noise will not be noticeable once the antenna is connected.

But if you find that the intrinsic noise is *still* dominant and you want to take a little more trouble to reduce it further, you can go to a configuration like that shown in Fig. 3(c), with the preamp mounted right at the antenna. This is the optimum configuration for minimum noise figure, but the inconvenience of it is only warranted if the extrinsic noise is still below the intrinsic noise with the preamp installed at the receiver.

If after going to this configuration you find that your system noise floor is *still* dominated by the intrinsic noise, then you are either in a very quiet locale (lucky you) or you have a noisy preamp. In any case, if you are still in the game at this point, the next step is to buy or build a better and quieter preamp. But if you have done everything right up to this point and there are no serious problems with your equipment, you should be able to hear the satellite fairly well (a 10-dB output signal-to-noise ratio or better) if you have a 10-dB gain antenna.

One word of warning. High-gain preamps sometimes have a tendency to oscillate, especially if not terminated in impedances of exactly 50 Ohms, resistive, at input and output. If you find a lot of noise coming out of your preamp—either sporadically, like lightning crashes, or continuously—your preamp may be oscillating.

Antennas

You will want to use a gain antenna of some sort, preferably about 10 dB gain or more, and it is a good idea to spend some time characterizing the "noisiness" of your environment at various azimuths and elevations. Having done this, you will know in advance those beam headings that can be expected to produce good and bad signal-to-noise ratios for the same strength of satellite signal. Keep in mind, however, that the noise sources in the environment around you may change with time, so consider this just a general determination of good and bad areas.

For any particular operating occasion, the optimum procedure is to first determine the beam direction (azimuth and elevation) that yields the strongest signal from the satellite and then tune away from the satellite signals and try to find a beam direction in that general area of the sky that also minimizes the noise pickup. The idea being, or course, to maximize the *ratio* of received signal to received noise at the receiving system's input terminal.

Note that if your system noise floor is dominated by extrinsic sources, you may not notice any improvement in output signal-to-noise ratio by installing a larger, higher-gain antenna. Depending upon the side-lobe gains of the antennas as installed, the *ratio* of satellite signal to noise signals may increase, decrease, or not change at all when changing antennas since the noise sources in your environment are likely to be distributed in azimuth around you.

Circular Polarization

All available literature strongly recommends right-hand circular polarization (RHCP) for your AO-10 antennas. I will not contradict this advice since intuitively RHCP seems like the right thing to use, but my observations of the AO-10 beacon signal as well as general signals in the passband have shown that antenna polarization (whether linear or circular of either sense) usually makes no observable difference in the strength or quality of the downlink signals. I have not heard any credible explanation for this phenomenon, nor will I attempt to offer one.

Sometimes RHCP does work better than the others, but even with RHCP there is usually very strong spin modulation (fading) on the signals.

A Case Study

It might be interesting to relate the results of this sort of characterization on *my* downlink station.

My baseline 146-MHz receive system consists of an Advanced Receiver Research (ARR) R144VD downconverter working into a Drake R-4 running at 30 MHz. The R144VD has a noise figure specification of less than 1.8 dB. My preamp is an ARR P144VDG GaAsFET unit with a noise figure of less than 0.5 dB and gain of better than 24 dB, as specified by the manufacturer. (These absolute performance figures were not checked by measurement, due to lack of test equipment. The preamp and converter were both new, however, at the time of the measurements which follow.)

The antenna used for these tests was a 4-element linearly-polarized quad with a measured gain of 9 dB over a dipole.

The series of tests described in this article were carried out on this sytem, with several interesting results. The act of adding the preamp to the system at the downconverter (the configuration shown in Fig. 3(b)) improved the output (S+N)/N ratio by about 3.4 dB over that obtained with the configuration of Fig. 3(a).

Installing the preamp at the antenna (the Fig. 3(c) configuration) instead of at the converter improved the output (S+N)/N ratio by *another* 3.5 dB. (The feedline involved here is 85 feet of new RG-213 with a measured loss of 0.87 dB at 146 MHz.)

Even with the basic Fig. 3(a) system configuration, however, the local atmospheric noise averages 3–10 dB above the system intrinsic noise, while the AO-10 beacon signal appears at 3 to 10 dB above the local noise at various times. If local noise were not present, I would be able to hear the satellite's beacon with a quite respectable signal-to-noise ratio of 10 to 20 dB though, even without a preamp.

Since in this case the local noise exceeds the intrinsic noise even without the preamp, the reduction in system noise due to adding the preamp has no effect on

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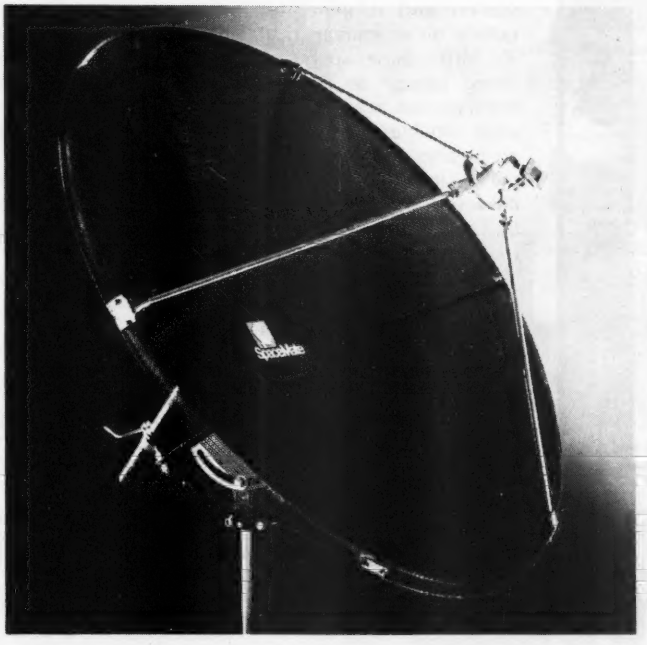

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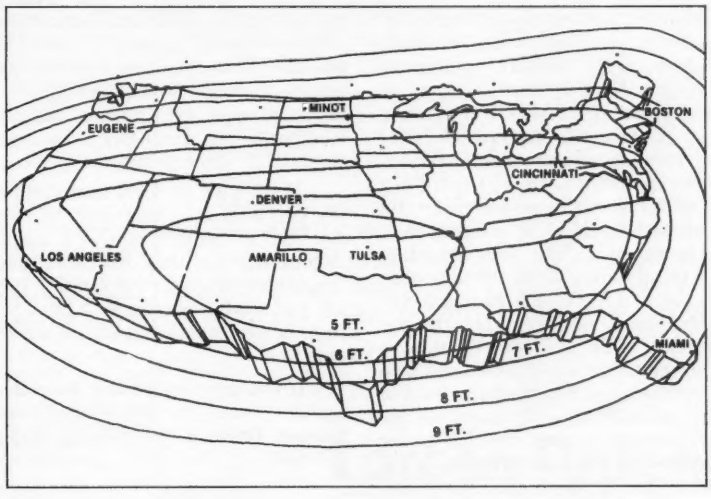

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output signal-to-noise ratio. Were I in a very quiet location, however, adding the preamp mounted at the antenna would improve the output signal-to-noise ratio by 6.9 dB, which would be significant.

I do use the preamp in my system anyway, however, because of a secondary benefit. I use a computer in my station and it generates quite a bit of spurious rf at 30 MHz; these spurs are strong enough to degrade the reception quality of the weak satellite signals when no preamp is in use. Since the preamp boosts the signal levels at the 30-MHz i-f by 24 dB, however, it places the desired signals well above the computer spurs and improves the reception quality in that way, even though my output signal-to-noise ratio due to thermal noise is still dominated by the extrinsic noise and therefore is not improved by the preamp.

Summary

I have described a series of simple tests that can be carried out on any receive system with minimal test equipment to characterize the noise performance of that system relative to the local noise environment. This type of characterization is much more meaningful than an absolute characterization, such as a standard noise figure test, since the effects of the local environment are considered.

Using these procedures it is possible to determine in advance whether or not the addition of a preamp to a system is likely to improve output signal-to-noise ratio, as well as whether or not it is worth the inconvenience of mounting the preamp at the antenna.

In the end, you may not be happy with the quality of the downlink signals at your station, but at least you'll know why they are the way they are. ■

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*A digital communications technique of continually adjusting an internal clock to match the received signal's bit rate.

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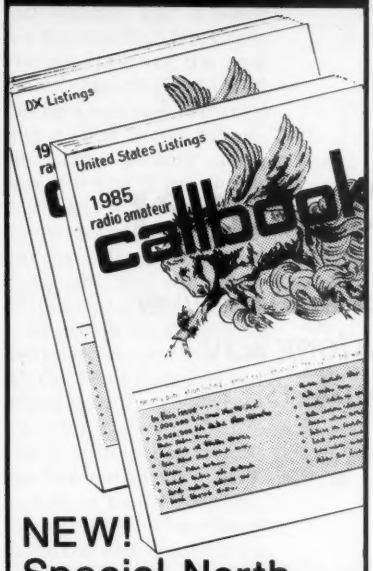

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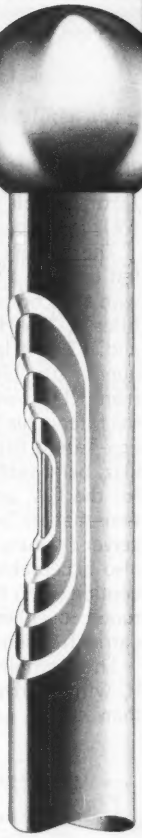

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The 30-Meter-Plus Receiver

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Most of the older amateur rigs have no provision for the 30-meter band or for receiving the commercial CW and broadcast stations that also occupy the HF region. The receiver described in this article tunes 7.8 MHz to 12.1 MHz, which includes commercial CW and RTTY stations, SWBC, WWV, and the 30-meter amateur band. It is simple to build, easy to get operating, and doesn't cost a mint.

Fig. 1 shows the block diagram of the receiver and the schematics are shown in Figs. 2, 3, and 4. A single tuned circuit matches the antenna to the mixer and peaks the desired signal. A dual-gate MOSFET is used for the mixer, as it has a good noise figure and provides some gain, thus reducing the total number of stages in the receiver.

The vfo uses a JFET as a Hartley oscillator and another dual-gate MOSFET as a buffer amplifier. It is modeled on the W7ZOI and K5IRK design[1] but does not use the padding capacitance. This was left out in order to obtain the maximum tuning range from the oscillator, which is about 4.3 MHz in this case.

The output of the mixer is fed through a tuned circuit with a link output to a Heath filter of 2.1-kHz bandwidth and 3.395-MHz center frequency. The filter was a gift from KI4FJ, who replaced the filter in his SB-101 with a Fox-Tango filter. The 2.1-kHz bandwidth is suitable for the CW and RTTY stations that are found in the receiver's tuning range. It is also acceptable for AM reception when the receiver is tuned to either side of the carrier frequency.

The i-f amplifier is a single IC which provides better than 40 dB gain and provides the majority of the receiver's gain. To keep things simple, no agc is used. It is not necessary on CW and the manual i-f gain control on the front panel is adequate for the purpose. The output of this stage is taken through a link from L4. This transformer is single-tuned and peaked by the 300-pF trimmer in parallel with it.

The detector is the old standard single diode which functions well on AM. When an adequate amount of bfo energy is applied, it functions as a detector for CW, RTTY, and SSB. It was chosen for its simplicity and low parts count.

The bfo is a Colpitts crystal oscillator which was chosen for its simplicity and output. The switch from AM to CW operation is accomplished simply by switching the bfo's operating voltage on.

The audio section consists of two stages, a bipolar preamplifier and an IC audio power amplifier. The bipolar stage is necessary due to the small number of active stages ahead of the detector. There is sufficient gain for a small speaker and enough to blast a set of low-impedance earphones.

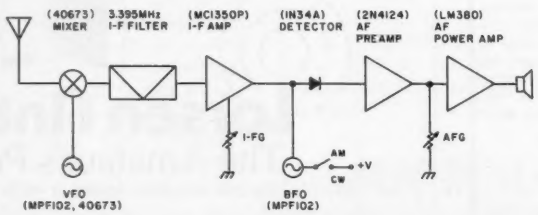


Fig. 1. Block diagram. The receiver operates on 12 V dc, uses low-impedance earphones or a speaker, and requires a low-impedance antenna.

Circuit Details

All coils were wound on toroid cores which were purchased from Amidon Associates.[2] Due to the large tuning range and the narrow filter, a gear reduction drive on the vfo tuning capacitor is a necessity. I used a WWII government-surplus capacitor from an ARC-5 transmitter which tuned 7.0 to 9.1 MHz. This was obtained at a hamfest but should also be available from other sources at a reasonable price.[3] It has a built-in gear reduction drive providing approximately a 49:1 turns ratio,

and a dial is also included. The unit provides less than 100 kHz of coverage per turn of the tuning knob, which allows easy tuning on CW. I covered the original dial numbers with a black felt pen and used typewriter erasure fluid for the new marks. The original small tuning knob was replaced with a large two-inch-diameter knob for more tuning ease. The cost of the surplus unit is less than the price of a new double-bearing capacitor, gear reduction drive, and dial when purchased separately.

My receiver is built in modular fashion. The two ICs can be mounted on predrilled boards such as those available from Radio Shack.[4] The other circuits can be wired on pieces of PC board in point-to-point "ugly" style.[5] This allows quick and easy construction and modification. I used a combination of etched boards and ugly boards in my receiver.

The crystal in the bfo was purchased at a hamfest. It should be available from Heath or it could be ordered from one of several crystal manufacturers.[6]

My receiver was built in an aluminum cabinet which measures 3-1/2 inches high, 8 inches wide, and 9-1/2 inches deep. This was purchased at a hamfest for less than three dollars. Allow plenty of room for the front-panel controls: vfo knob and dial, antenna peaking knob, i-f gain knob, AM/CW switch (bfo power), af gain knob, earphone jack, and on/off switch. The rear panel contains a power connector and antenna jack. The receiver could easily be built in a smaller cabinet, but I like to have extra room for servicing and modifications.

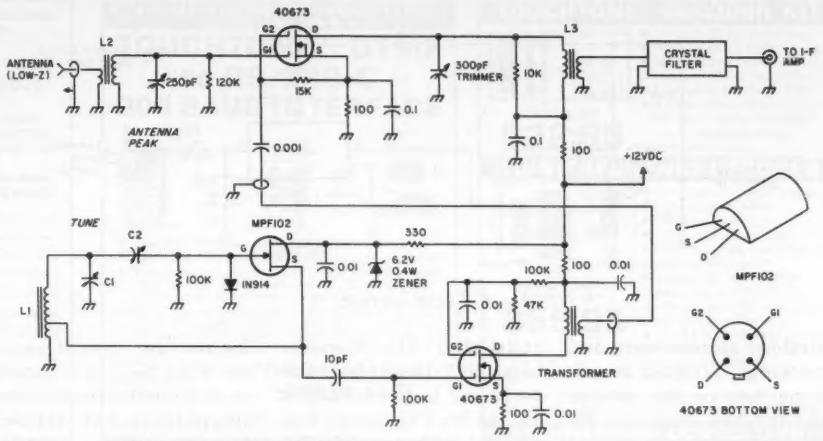
Construction

The following sequence is recommended. Build the LM380 section first, then the preamp, the i-f, the detector, the bfo, the vfo, and finally the mixer. The bfo can be used as a signal generator to align the i-f transformers.

To do this, first disconnect the bfo output from the detector and reconnect it to pin 4 of the i-f amplifier. Plug in a set of earphones and turn on the power. Adjust the 300-pF trimmer in parallel with L4 for maximum noise or hiss output. Use a nonmetallic tool for this. Next, turn off the power and move the output of the bfo from the i-f to the drain lead of the mixer. Disconnect the filter from the circuit and connect the link of L3 to the coupling capacitor going to pin 4 of the i-f amplifier. Turn on the power and adjust the 300-pF trimmer in parallel with L3 as you did the other for maximum output. Turn off the power and reconnect the filter in the circuit and connect the output of the bfo to the anode of the detector.

If a frequency counter is available, dial calibration is easy, as the vfo operates 3.395 MHz lower in frequency than the tuned frequency. The dial can be calibrated by connecting the counter to the output of the vfo and adding 3.395 MHz to the counter's reading. For example, to tune 10.1 MHz, set the vfo to 6.705 MHz.

If a counter is not available, the following can be



C1 170-pF capacitor from ARC-5 transmitter
C2 1.5-5.4-pF air trimmer
L1 44 turns, tapped at 12 turns above ground on Amidon T50-6
L2 24 turns wound on Amidon T68-2; 3-turn link to antenna
L3 50 turns wound on Amidon T50-2; 22-turn link to filter
XFMR 18 turns wound on Amidon FT37-43; 3-turn link to mixer
Filter is Heath part number 404-200 (Made by James Knight Company), 2.1-kHz bandwidth, 3.395-MHz center frequency.
Note: #28 enameled copper wire was used for all windings.

Fig. 2. Schematic of mixer, filter, and vfo sections.

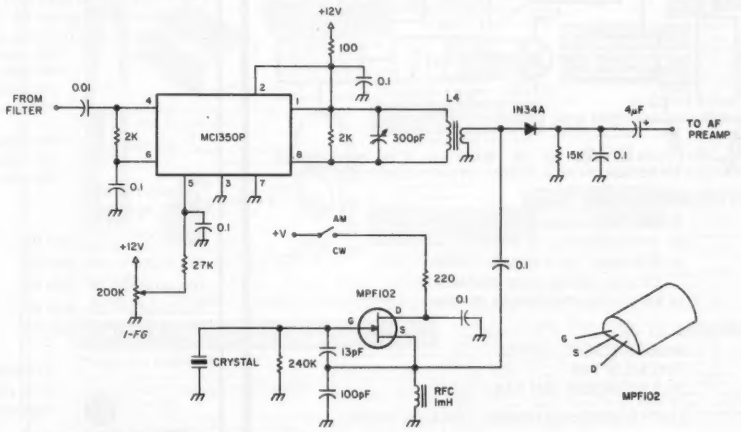


Fig. 3. Detector, i-f amplifier, and bfo schematic.

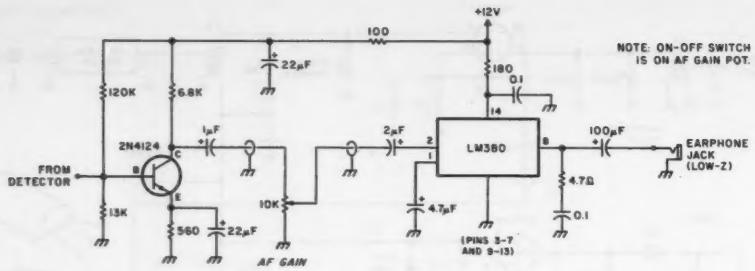


Fig. 4. Audio section.

used for approximate dial markings: Without an antenna, turn on the receiver and the bfo. Tune for the bfo's third harmonic at about 10.191 MHz. This should be easy to locate and will be found approximately at the midpoint of the dial. Next, connect the antenna and tune a little lower in frequency. The lowest frequency occurs when the vfo's capacitor is fully meshed and the antenna capacitor is almost fully meshed. If the time of day and conditions are right, you should be able to find WWV at 10 MHz. The 30-meter band, 10.1–10.15 MHz, will be found between WWV and the bfo's harmonic. You will find the 31-meter SWBC band just below WWV and the 8.5-MHz commercial CW band a bit further down. The 25-meter SWBC band will be found near the top of the vfo's range. If a crystal calibrator is available, additional tuning marks can be made as you wish.

To operate the receiver, set the i-f gain at maximum and peak the antenna capacitor for maximum noise with an antenna connected. The receiver is most sensitive when the bfo is turned on, so it is left on even when tuning in an AM station. Once the station is found, the bfo is turned off and the receiver is fine-tuned for best audio response. The af gain control is set for a comfortable listening level and the i-f gain is adjusted to prevent overloading of the detector. CW and RTTY stations are tuned in a similar manner, except that the bfo is left on. The antenna tuning capacitor will be quite sharp at low frequencies and will require frequent adjustment. At the upper end of the dial, frequent adjustment will not be necessary.

I have had a lot of pleasure from this receiver and hope that you will, too. If you have any questions or comments I will try to answer them if you enclose an SASE. ■

References

1. "A Progressive Communications Receiver," W7ZOI and W5IRK, *QST*, November, 1981, p. 11.
2. Amidon Associates, Inc., 12033 Otsego Street, North Hollywood CA 91607.
3. Fair Radio Sales, 1016 E. Eureka Street, PO Box 1105, Lima OH 45802.
4. Radio Shack items #276-024 or 276-159.
5. "The 'Ugly Weekender'," KA7EXM and W7ZOI, *QST*, August, 1981, p. 18.
6. Two crystal manufacturers that I have used with satisfaction are: International Crystal Manufacturing, 10 North Lee, Oklahoma City OK 73102, and Jan Crystals, PO Box 06017, Fort Myers FL 33906.

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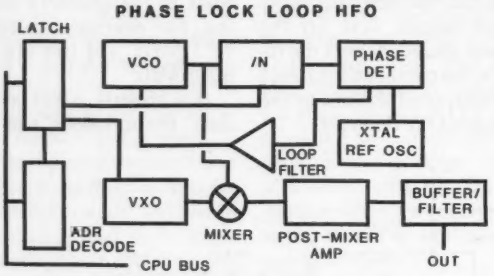

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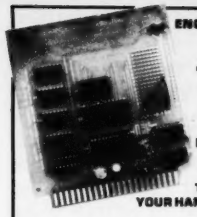

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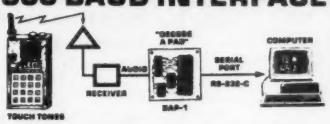

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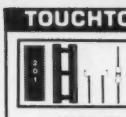

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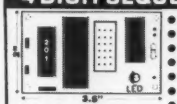

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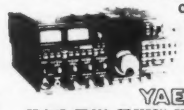

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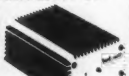

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One of our measuring instruments is missing! We have capacitance meters, ohmmeters, and frequency counters, to say nothing of volt and current meters. But we don't have a small inexpensive instrument for inductance (L) and Q. Impedance bridge and similar methods are costly and often limited in frequency range. What one would like to do is to be able to measure inductance from small fractions of a microhenry to thousands of henrys and do it from a few Hertz to tens of megahertz. With the L Meter and a frequency counter you can now measure inductance and find the resonant frequency of tuned circuits as well.

The L Meter is different in that it provides the unknown inductance not only with a selectable tuning capacitor but also with an adjustable negative resistance to make it oscillate. The counter measures the frequency of oscillation and, knowing the tuning-capacitor value, permits the inductance to be calculated. Of course, much of the time the use of a reactance chart to find the inductance is accurate enough. The reactance chart also gives the reactance, X, of the coil, and the L Meter gives the anti-resonant impedance, QX. The ratio is Q so you can also find shorted turns, etc. If you have a TI-58 or -59 calculator with the electrical engineering module, these calculations are easily done with program EE-11, Reactance Chart.

The heart of the L Meter is the trio of transistors, Q1, Q2, and Q3. See Fig. 1. The first two are followers driving Q3, which is a grounded-base amplifier. The gain

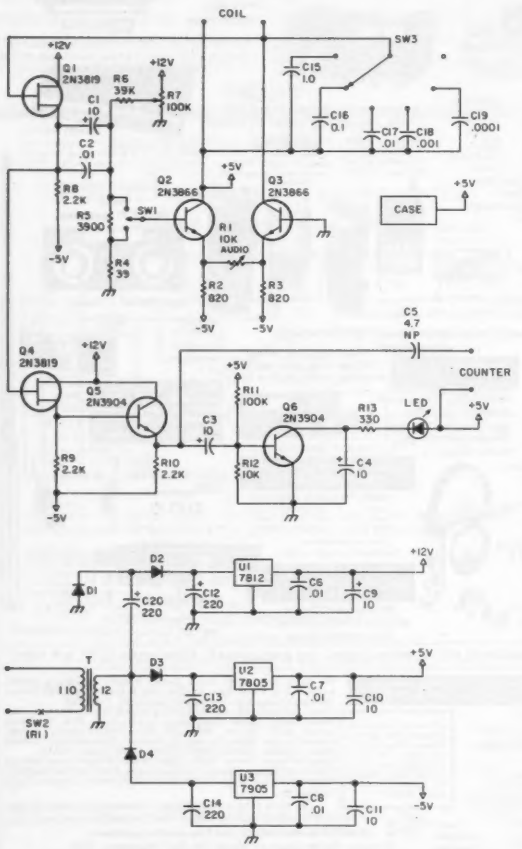

Fig. 1. Schematic.

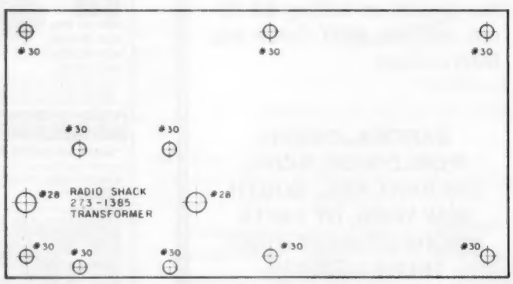

Fig. 2. Perfboard, hole placement.

around the loop is controlled by the shunt impedance of the tuned circuit and the series resistance of R1. If the transistors were ideal, then unity gain would occur when these two impedances were equal. Actually R1 has to be about 85% of the tuned-circuit impedance to make up for the losses around the loop.

Suppose the tuned circuit is oscillating with a voltage, V. With switch SW1 on the times 1 contact, Q1 and Q2 deliver a little bit less than V at the emitter of Q2. Since the emitter impedances of both Q2 and Q3 are low, the current into the emitter of Q3 is a bit less than V/R1. Most of the current into the emitter of Q3 comes out the collector and produces voltage across the tuned circuit. Q1 does not take any significant current because it is a field-effect transistor and it is a follower. Thus, if the coil has a reactance, X, and a quality factor, Q, the largest value of R1 that will let oscillation continue is approximately equal to QX. In order to measure tuned-circuit impedances up to a megohm, switch SW1 reduces the follower gain by 100 and multiplies the R1 scale by 100.

To make a useful instrument a few more things have to be added. Obviously we need a power supply and a switched bank of capacitors for the tuned circuit. We also need an output to the counter that does not load down the tuned circuit and disturb the measurement. We also need an indicator to tell when the circuit is oscillating.

R1 must be adjusted to make the circuit barely oscillate. We want oscillation but not overload which would give frequency shift and measuring error. Also, to make the adjustment of R1 quick and simple, we do not want to wait to see if the counter is responding. Thus, followers Q4 and Q5 pick off the signal for the counter and also drive Q6, the oscillation detector. Q6 is biased so that even a .1-volt signal will cause the LED to start to glow. This will detect oscillation in tuned circuits even when their anti-resonant impedance is less than 100 Ohms.

The power supply is conventional except that three voltages are delivered and all are regulated. The regulation is needed to allow the circuit to stay on the edge of oscillation without constant readjustment. Also, regulators are a simple way to filter out hum. Ideally the transformer should deliver about 8 volts and some 6.3-volt units do. However, many do not, being wound with bigger wire and therefore allowing for less drop under load. The 12-volt unit is sure to work.

Because the frequency of oscillation can cover such a wide range, it is important to keep leads short and to bypass the power-supply outputs carefully. The coupling capacitors, C1 and C2, must be low impedance to the signal. The use of an electrolytic capacitor in parallel with a ceramic provides the wide frequency range bypass action. For the same reason transistors Q1 and Q2 are 500-MHz units.

To measure inductance from 1000 H to .1 uH covers a range of ten decades. Letting the frequency go from 5 Hz to over 50 MHz, seven decades, allows us to use only 4 decades of capacitor tuning range. Since small inductors tend to tune with small capacitors and to higher frequencies, the L Meter only needs to measure about a four-decade range of anti-resonant impedance. In addition, the higher impedances tend to be at the lower frequencies, where it is easier to maintain high transistor-input and -output impedances. Thus these factors work together to make the L Meter an accurate, wide-range, inductance-measuring device.

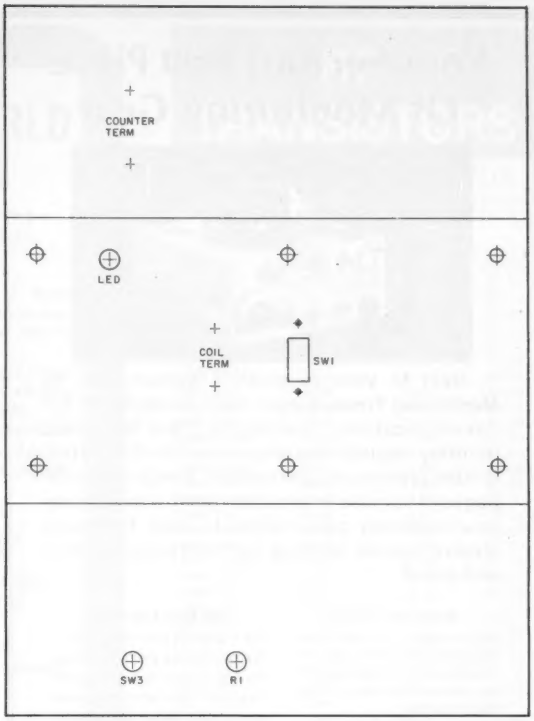

Fig. 3. Drilling positioning guide.

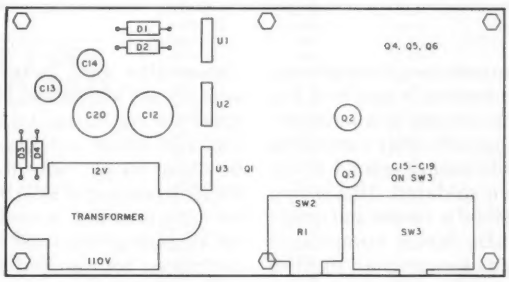

Fig. 4. Parts placement, bottom view.

Construction of the L Meter can start with drilling the necessary holes in the 2-1/2" by 4-3/4" piece of perfboard. See Fig. 2. The perfboard will be mounted on the aluminum box with six 1" 4-40 machine screws. Six are used to maintain rigidity. Fig. 3 shows the corresponding drilling and cutout information for the 5" by 3" by 2" box. Note that only the part whose panels are all 5" long gets drilled. The part with the 2" by 3" ends is used as is.

The transformer can be mounted on the perfboard first, keeping the 110-volt terminals towards the outside edge of the board. Fig. 4 gives a suggested layout of the parts. Mount the parts by bending the leads as appropriate and pushing the leads through the holes in the board. Using long-nose pliers, the leads can be bent as shown in Fig. 5 to clinch the part to the board. Much of the part-to-part wiring can

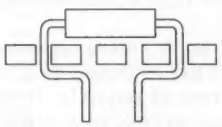

Fig. 5. Lead clinch.

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Parts List

Capacitors	
C1, C3, C4, C9, C10, C11	10 uF, 25 volt, electrolytic
C2, C6, C7, C8	.01 uF, ceramic
C5	4.7 uF, 16 volt, nonpolar
C12, C13, C14, C20	220 uF, 35 volt, PC
C15	1 uF, 50 volt, film
C16	.1 uF, 50 volt, film
C17	.01 uF, mica
C18	.001 uF, mica
C19	.0001 uF, mica
Resistors, fixed are 1/4 W, 5%	
R1	10k pot with switch, audio taper
R2, R3	820 Ohm
R4	39 Ohm
R5	3900 Ohm
R6	39k Ohm
R7	100k trimpot
R8, R9, R10	2.2k Ohm
R11	100k Ohm
R12	10k Ohm
R13	330 Ohm
Semiconductors	
D1, D2, D3, D4	1-Amp 100-volt rectifiers
U1	7812 12-volt regulator
U2	7805 5-volt regulator
U3	7905 – 5-volt regulator
Q1, Q4 RS 276-2035	2N3819 FET
Q2, Q3 RS 276-2038	2N3866 500 MHz NPN
Q5, Q6	2N3904 NPN
LED	light-emitting diode
Miscellaneous	
SW1	SPDT slide switch
SW3	SP6T rotary switch
Perfboard	
Transformer	110 volt to 12 volt, 300 mA
4 push-button terminals	
Power cord, grommet	
2 3/4" knobs, 1/4" shaft	
Bond paper	
6 1" 4-40 machine screws, nuts and lock washers with 6 5/8" fiber spacers	
Aluminum case, 5" × 3" × 2"	

be made using the lead wires themselves. A lead as in Fig. 5 can be used as a wiring terminal with other connecting leads wound around it and then soldered. This wiring method is simple and quick. It also leaves component leads longer than printed wiring does, which is helpful when you want to salvage parts from a discarded project.

Ideally, tuning capacitors C15 to C19 should be as accurate as possible. If you have access to a capacitance meter you can select the appropriate units. Even if you cannot find units within a few percent of the values, 1.0, 0.10, 0.010, 0.0010, and 0.00010 uF, you can at least record the values so that when you need accuracy you can calculate using the actual capacitance. Remember the circuit has about 40 pF of stray capacitance, so allow for that in the 1000-pF unit. Also, the fifth capacitor ought to be chosen after the L meter is working and in the case. The total tuning capacitance should be 100 pF, so C19 will be about 60 pF. Note that the sixth position of SW3 has no capacitor. This is useful for measuring very small inductances. You can find the value of the stray capacitance by measuring a small inductor using a larger capacitor, say 0.001 uF, and then finding the frequency with strays only. With the measured inductance and the strays-only frequency, the stray capacitance can be found.

Glue a 4" by 2" piece of bond paper to the side of the case where switch SW3 and R1 are mounted. Install the knobs. Using a sharp pencil mark the six switch positions and their capacitance values. Then connect an ohmmeter to R1. Mid-scale should be about 1500 Ohms. If not, you are using the wrong end of the pot. One side of R1 must be disconnected from the circuit to measure R1. Mark an Ohms scale from 100 to 10,000 Ohms. Measure 30 Ohms and mark it as 50. This allows for series emitter impedances. This calibration is accurate enough for most purposes. A more accurate scale can be created by starting with a very high impedance tuned circuit and shunting it with various resistors, calculating the net shunt resistance and marking the scale accordingly. Remember to always set R1 to the point where oscillation just starts.

One other detail: Set R7 so that the voltage at the emitter of Q2 does not change when switch SW1 is operated. You will also note that the coil being measured carries about 5 mA of direct current. Some large, metal-cored coils may be sensitive to this current. A PNP transistor can be arranged as a current source from the +12 supply to the collector of Q3 and adjusted to make the coil current virtually zero. If you try this, be sure to bypass the base of the PNP to keep signal off the base. Otherwise the current source will load the tuned circuit. The disadvantage of the current source is that it adds stray capacitance. ■

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If the regulator should fail, causing the output voltage to climb toward the input voltage of the regulator, the 12-volt zener diode, Z1, will turn on at 14.4 volts in conjunction with the gate of the SCR, which will turn the SCR on, causing the fuse, F2, to blow, which will remove the current from the regulator, preventing damage to equipment used with this power supply. R6 and C5 are used as a filter to prevent the SCR from false triggering.

This power supply works very nicely with my 30-Watt KLM amplifier and my ICOM Model IC-2AT. ■

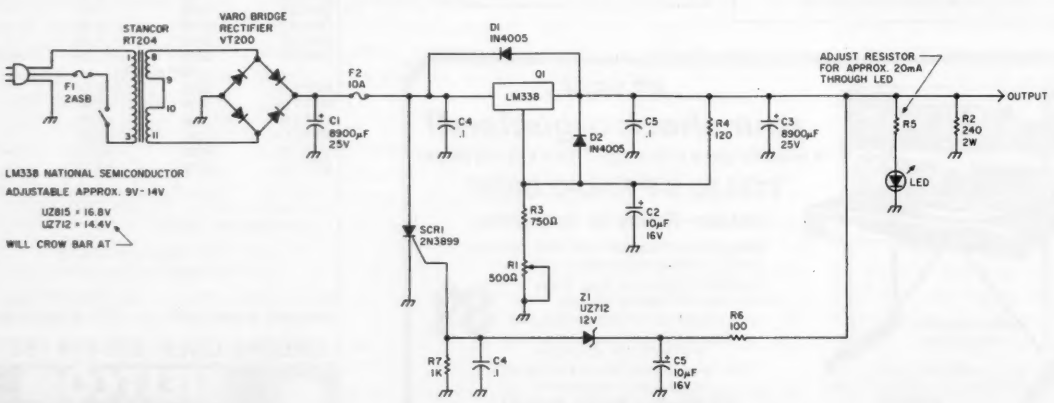
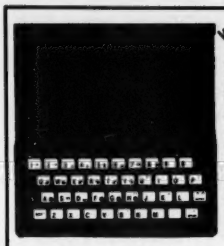


Fig. 1. 12-V-dc power supply with crowbar protection.



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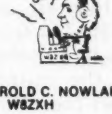

"HAL" HAROLD C. NOWLAND
W8ZXH

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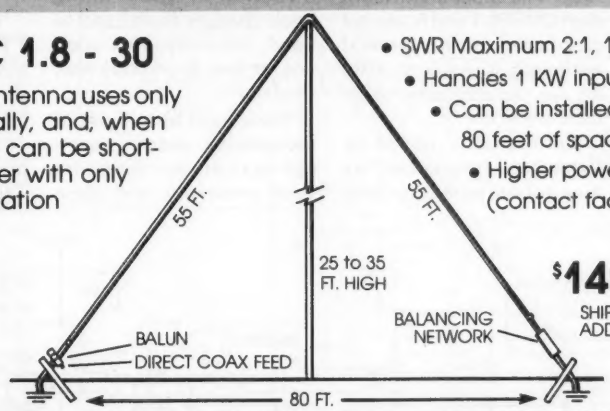

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Thomas M. Miller WA8YKN
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The modern generation of amateur-radio transceivers is fascinating, replete with features undreamed of only a few years ago. Like most hams, I'm fond of bells and whistles, but rather than rushing out to buy the latest gadget, I enjoy studying these features to learn "how it's done," then incorporating them into my existing equipment. The main rig here at WA8YKN is a Ten-Tec Argonaut. Over the years, this little "QRP" rig has grown a 500-Watt amplifier, an internal CW filter, a speech compandor, transverters for VHF and UHF, and probably the most useful of modern features, the digital frequency display.

Like many transceivers, the Argonaut has a 9-MHz i-f. Whatever frequency is received must be mixed with the signal from the vfo to produce 9.000 MHz. For example, when tuned to 7.1250 MHz, the vfo is running at 16.1250 MHz. It's evident that all we need here is a four-digit frequency counter to display .1250 and we can find our way around the band with 100-Hz accuracy. The most significant digits (MSD), 1 and 6, are not displayed, so no mental arithmetic is required. After all, we can remember what *band* we're on!

Unfortunately, not all intermediate frequencies are nice round numbers. Suppose the i-f were 455 kHz: The display described above would read .5800 when tuned to 7.1250. Not too useful, is it? To solve this problem, the counter circuit allows presetting of each digit. This way, any i-f can be accommodated by programming the proper offset into the display. The result is a very simple and inexpensive device which can easily be added to many transceivers and receivers. The only hitch is that the vfo must tune in the same direction as the desired frequency. If the direction of your tuning knob changes from band to band, I'm sorry. This one's not for you. Everybody else, read on!

There must be millions of inexpensive general-coverage receivers out there with good sensitivity, and these receivers perform very well for casual shortwave listening. However, all of these share a common drawback: the terrible "slide-rule dial," which makes it impossible to resolve the frequency being tuned with any degree of accuracy. The addition of a digital display to an older general-coverage receiver such as the Radio Shack DX-160 makes it a much more valuable device for many ham-shack uses, as well as enhancing normal shortwave listening.

Circuit Description

The circuit uses "LS"-type TTL integrated circuits throughout for low cost and simplicity. A 7400 serves as a 1-MHz oscillator, with three 7490 divide-by-ten stages producing a 1000-Hz clock. This signal feeds a 7493 di-

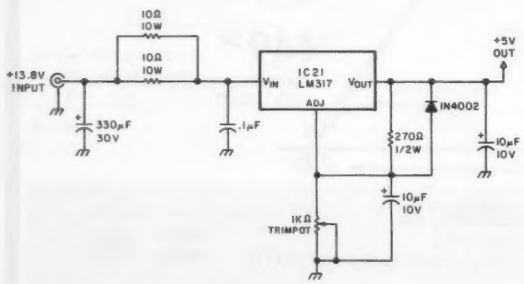


Fig. 1. Power supply.

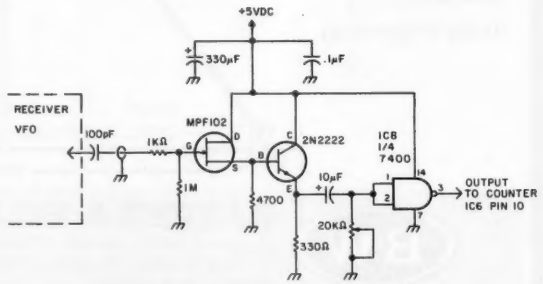


Fig. 2. Input circuit.

vide-by-twelve stage, which with a few supporting gates produces the count, latch, and reset signals. The count window is ten milliseconds long, giving 100-Hz resolution.

Each decimal counting unit (DCU) is made up of three integrated circuits and a seven-segment LED display. The heart of the DCU is the 74196 counter. Similar to the 7490, this IC is a decade counter. However, the 7490 can only be reset to zero or nine, while the 74196 can be preset to any number by placing the binary equivalent on the preset inputs and pulling pin 1 low. Small four-pole DIP switches are used to select the preset number. With all four switches closed, the display will read zero. Binary A-B-C-D is weighted 1, 2, 4, and 8. To select 5, for example, A (1) and C (4) would be switched "open."

The outputs of the counter go to the latch, a 7475, where the binary number is stored while the counter is reset and starts another count cycle. The latch signal on pins 4 and 13 of the 7475 goes high for 1 millisecond at the end of each count window, loading the resulting number from the counter to the display. A low on pins 4 and 13 freezes the outputs.

Converting the binary-coded number into a seven-segment format for display is handled by the 7447 decoder-driver IC. The seven outputs drive a common-anode LED display through seven resistors (330 Ohms each) to limit the current through each segment to about 15 milliamps.

Four DCUs are built. The reset and latch signals go to all four DCUs in parallel, but the vfo signal being counted only goes to the first counter, the one displaying the hundred-Hertz digit. The "D" output (pin 12) of this counter drives the input (pin 8) of the next counter, and so on.

The four-digit display gives the Argonaut 100-Hz resolution.

If the display is going to be used on a general-coverage receiver, it may not be necessary to read to one hundred Hertz. If you don't need this much accuracy, just omit the latch, driver, and readout for this digit. The 74196 counter must remain to eliminate the "plus or minus one digit" error, maintaining the display accuracy.

The input circuit has three important functions: It presents a high input impedance to avoid loading down the vfo, it amplifies and squares the waveform for counting, and it also isolates the vfo from any digital noise generated by the display itself. Three circuits were built before the one presented here was selected. It gives good performance with the minimum parts count. When a TTL gate is fed through a capacitor, the input tends to drift high and "lock up." To prevent this, a 20k pot is connected from the input of the 7400 gate to ground and adjusted for the desired sensitivity. This is a very broad adjustment and, once set for the signal level of the vfo, will cover the high-frequency spectrum with no further attention.

The display requires five volts at just under one Amp. Since the Argonaut has 12 V dc available at the accessory jack, a simple series regulator was built using an LM317. The power is supplied to the regulator through two paralleled 10-Ohm, 10-Watt resistors which dissipate about half of the excess voltage. The regulator itself is mounted on a heat sink on the rear of the display. Neither the resistors nor the regulator gets too warm, but ventilation should be provided over the resistors.

The power supply in the DX-160 receiver would not handle any additional load, so for that display the regulator was fed from the same 13.8-volt bench supply that powers the Argonaut. The three-digit version only draws 600 milliamps.

Construction

Nothing is critical in this circuit, and the prototypes were built on 6″ × 8″ perfboard and wired point to point. 18-gauge bare-wire buses were run across the board from +5 volts and ground. Sockets can be used if you like. I didn't use sockets and had to replace a defective chip the hard way.

Although the circuit looks complicated, it can be built in several simple "blocks." The power supply, clock, control logic, and each DCU can be wired and checked

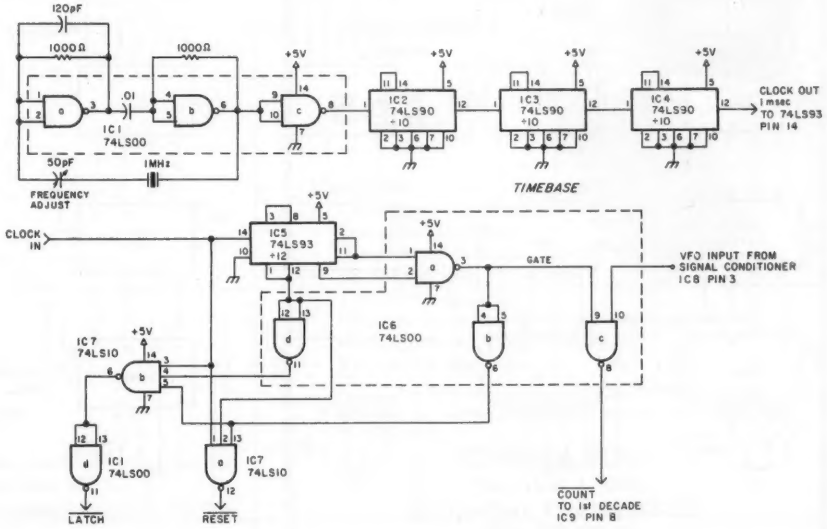
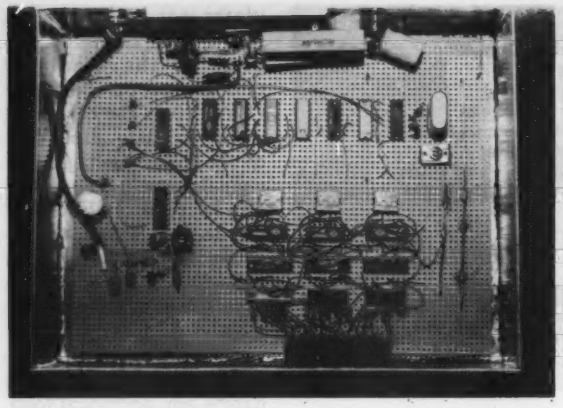


Fig. 3. Control logic.



Inside the three-digit version. The voltage regulator is mounted on the back wall of the cabinet on a sheet-aluminum heat sink. In the center, DIP switches are preset for 545 kHz.

The slide-rule dial on the DX-160 is used only to determine the frequency to the nearest megahertz. The simple three-digit display resolves to 1 kHz.

out individually. A scope is most useful for checking proper operation of the clock and control circuits. Also, a digital voltmeter is handy to set the regulator between +4.9 and 5.1 volts.

The displays were mounted at a right angle to the board, making a low-profile unit which can be placed on top of the transceiver or receiver.

In the interest of good shielding, the frequency display was housed in a box made of copperclad fiberglass circuit-board material, soldered at all seams. RCA jacks were used for power and vfo inputs. The opening for the LEDs was made with a Radio Shack nibbler tool, which cuts the PCB material nicely. The perfboard was mounted in the enclosure on one-inch-long 4-40 bolts and plastic-tube standoffs. The enclosure was painted and stick-on rubber feet were placed on the bottom. A piece of red tinted plastic was cut slightly larger than the opening for the displays and taped to the inside. I found school notebook dividers in see-through colors at the local K-Mart (39 cents each) and the red ones were perfect.

Tapping into the vfo output with a 100-pF capacitor caused only slight pulling of the oscillator, and no ill effects resulted. If your particular vfo has less output, a slightly larger coupling cap may be required. Use the smallest capacitor that will give enough signal to drive the display. An RCA jack was mounted on the back of the Argonaut chassis for the vfo output. Be sure to use good shielded cable here, and keep it short. Also, if your rig is tube-type, be sure the voltage rating of the capacitor is adequate!

The timebase can either be aligned with a frequency counter or by setting a harmonic to zero-beat with WWV.

Most vfo's have a fairly constant output through the tuning range. If yours varies much, tune it to the frequency where the output is weakest (usually the high end) and adjust the 20k trimpot on the input gate until the display starts reading the vfo frequency. That's all there is to it.

All that's left now is the i-f offset. If you have an even i-f (like 9.0), just set all the DIP switches closed. If you have another i-f such as 455 kHz, then you must program the offset into the counter presets.

Let's use the common 455-kHz i-f as an example. If

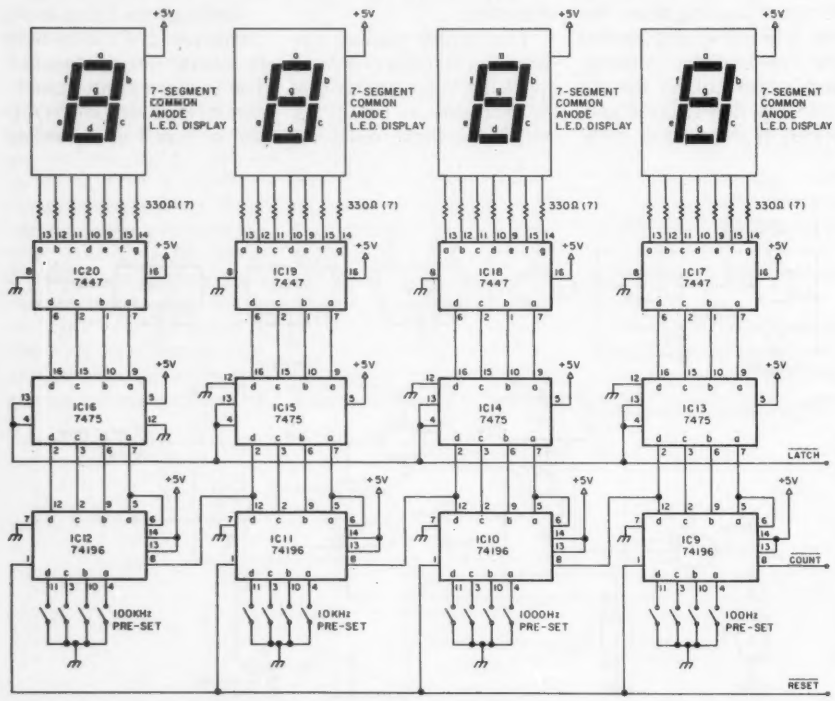


Fig. 4. Counter and display logic.

the vfo reads out on the display 455 kHz *lower* than the received frequency, you must program 455 kHz into the counter. Find the DIP switch for the left-most digit (100 kHz) and open the switch for binary C (pin 3 on the 74196). On the next digit (10 kHz), open the switches for binary A and C (pins 4 and 3 on the 74196). The next digit is also a 5, so it also gets switches A and C opened. The switches for the hundred-Hertz digit are all closed. The counter will now start each count period from 455 kHz, in effect adding that number to the count.

But what if your vfo runs 455 kHz *above* the incoming frequency (most of them do)? Just subtract 455 from 1000 and program the result (545 kHz, in this case) into the switches as described before. The counters will actually be displaying one MHz higher than the frequency we are tuned to, but since we don't display the MHz digit, we never notice.

There are several reasons for using discrete TTL ICs instead of a single-chip LSI counter. TTLs are cheap. Everything required to build this digital frequency display can be ordered from Circuit Specialists for under $35.00. (Circuit Specialists, Inc., PO Box 3047, Scottsdale AZ 85257.) Also, TTL counters work well to around 40 MHz, and most single-chip counters quit cold around 10 MHz, requiring prescaling.

Another advantage to building with discrete devices is the ease of modification to fit your requirements. Want 10-Hz or even 1-Hz resolution? Just add a few more divide-by-ten stages to the clock and switch select the resolution you want (be prepared to see your vfo drift, however). If you don't need the i-f offset feature, you could use 7490s in place of the 74196 counters. The pinout is different, of course, and the reset signal will have to be inverted, but it will be slightly simpler and cheaper.

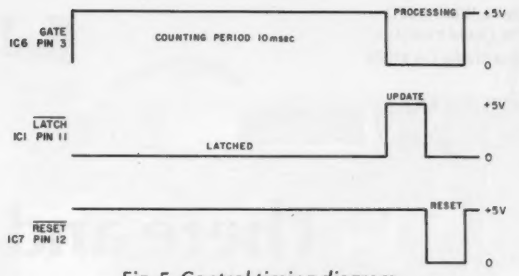


Fig. 5. Control timing diagram.

It is also possible to build two more decade counting units and display the entire frequency, including the megahertz digits. I didn't do this since the original dial was adequate for that purpose, and the primary goal was a frequency display that provided precise tuning with simplicity and minimum cost.

Using the Argonaut with the frequency display has been a joy. RTTY mailboxes are a snap to find, and it's now simple to "QSY up ten" without getting lost. Shortwave listening on the DX-160 has also taken on a new dimension. It's now possible to make accurate loggings of clandestine "spy" stations, press-service RTTY, military communications, and literally thousands of other fascinating signals. The DX-160/frequency display combination gives the type of performance previously reserved for receivers costing hundreds of dollars more.

So try the digital frequency readout on your rig. You don't have to envy the new kilobuck rigs for their bells and whistles! Build your own. ■

Parts List

IC1, IC6, IC8	74LS00
IC2, IC3, IC4	74LS90
IC5	74LS93
IC7	74LS10
IC9–12	74LS196
IC13–16	74LS75
IC17–20	74LS47
4	Common-anode 7-segment displays

Resistors

29	330-Ohm, 1/4-Watt
3	1000-Ohm, 1/4-Watt
1	270-Ohm, 1/4-Watt
1	4700-Ohm, 1/4-Watt
1	1-M, 1/4-Watt
2	10-Ohm, 10-Watt

Trimpots

1	20k
1	1k

Capacitors

1	10-uF, 10-V-dc
1	100-uF, 30-V-dc
1	330-uF, 30-V-dc
1	50-pF ceramic trimmer capacitor
1	LM317 voltage regulator
1	1-MHz series-resonant crystal
4	4-pole DIP switches

Miscellaneous items: RCA jacks, perfboard, materials for enclosure, wire, solder, mounting bolts, etc.

All parts are available from Circuit Specialists, Inc., PO Box 3047, Scottsdale AZ 85257.

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I purchased the new Kenwood TS-930S in December, 1982. It is a fine radio and, after some initial problems, has performed as advertised. After hearing of the features of the TS-430S and playing with one, there was one function not included in the TS-930S that made me jealous. That was the scanning feature. On the TS-430S you can program memory channels 6 and 7 and scan between them.

The existing up-scan or down-scan built into the TS-930S is virtually useless. It starts slowly and after 3 seconds speeds up so that it is useful only on the international broadcast or the AM broadcast bands where the bandwidths of the stations are very wide. It goes through single-sideband signals at a rate of knots and nothing can be heard or understood as it zips by. Even if you could discern the signals, the scan would never reset. It would go up or down until it ran out of radio spectrum and would stop at either 29.999.99 MHz or 100.00 kHz.

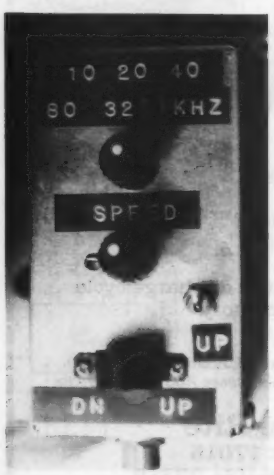
Band scan would be a desirable feature because you could monitor preset sections of a band without having to sit in front of the radio and twist the knob. You could monitor the DX portion of 20 meters for that rare one, scan the net activity on 75, or hunt through a portion of 8 MHz looking for interesting signals to pop up. All this could happen while you are in another part of the shack working on a project or writing an article.

It so happens that if you pulse the up or down control line on the TS-930S microphone connector, the radio will step at the same rate as the pulses. Each pulse moves the radio 10 Hz. For example, if you pulse the up line at a 20-Hz rate (pull the line to ground), the radio will advance 200 Hz a second. A 50-Hz pulse rate will advance the radio 500 Hz per second. With a simple 555 timer chip, a variable-speed scan rate can be achieved. Eventually, however, the radio will be out of the ham band and will happily continue all the way to 29.999.99 MHz and stop. Most unsatisfactory!

Since the TS-930S has memories and memory recall, we can put these functions to use. When we push the memory-recall button, the radio will always return to whatever frequency was programmed into the memory channel selected. If we use the above and add one function, a timer, we end up with a device that will pulse the radio along at a variable speed, determine how wide the frequency range should be, and return to a preprogrammed frequency.

Fig. 1 shows a simple way of performing the scan-recall function. The top 555 timer (IC1) is a pulse generator that pulls the up-scan line to ground at a variable rate, and the second timer (IC2) will pull the memory-recall line to ground after a user-selected time. This will reset the radio to a preprogrammed frequency. The problem with this method is that you end up with two variables, scan speed and reset time. Unless some specific preset variable resistors or capacitors were switched in for both functions simultaneously, you would never know the scan width accurately. Fig. 2 is a circuit to perform the above, but it was discarded prior to incorporation because of the inconvenience of the two variables.

What I needed was a method to count or accu-



The unit in its Bud box, top view.

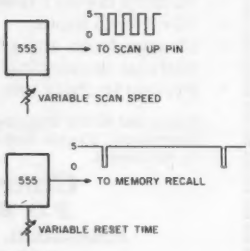


Fig. 1. Simple scan reset.

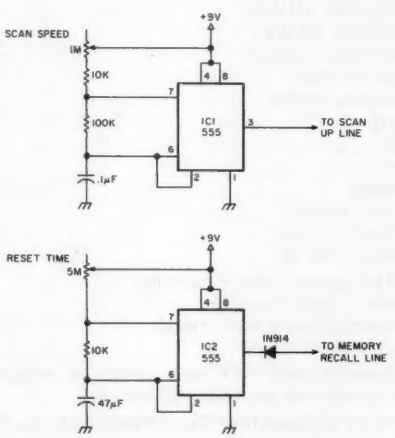


Fig. 2. Simple scan and reset circuit.

Count 2 to the	Counted Pulses	Approx. kHz	Switch Program (Pin #)* 9	10	11	12
9	512	5	0	0	0	0
10	1024	10	1	0	0	0
11	2048	20	0	1	0	0
12	4096	40	1	1	0	0
13	8192	80	0	0	1	0
14	16384	160	1	0	1	0
15	32768	325	0	1	1	0
16	65536	650	1	1	1	0
17	131072	1,300	0	0	0	1
18	262144	2,600	1	0	0	1
19	524288	5,250	0	1	0	1
20	1048576	10,500	1	1	0	1
21	2097152	21,000	0	0	1	1
22	4194304		1	0	1	1
23	8388678		0	1	1	1
24	16777216		1	1	1	1

*0 = ground; 1 = plus 9 volt.

Fig. 3. MC14536B program chart.

mulate the pulses from the 555 pulse generator. If a preset number of pulses were counted, then the scan width at 10 Hz per pulse would be determined independently of pulse speed.

The device I chose was suggested by Mike WA7ARK and Steve KE7G. It was the Motorola MC14536B programmable timer. This is a 24-stage ripple binary counter with the last 16 stages selectable by a four-bit code. (From the Motorola *CMOS Data Manual.*) It has 24 flip-flop stages and will count from 2^0 to 2^{24} pulses and then trigger, reset, and start again. Essentially it can be programmed to count from 2^9 (or 512) pulses to 2^{24} (or 16,777,216) pulses. Since each pulse represents 10 Hz to the radio, 2^9 would be 5120 Hz or approximately 5 kHz; 2^{10} would be 10,240 Hz or 10 kHz, etc. See Fig. 3 for the program and frequency information.

Fig. 4 is the block diagram of the selected design. The 555 pulses at a user-variable rate and the programmable timer uses the pulse rate as its clock. When the timer reaches its preprogrammed count, it pulses a transistor switch and pulls the memory-recall line to ground, resetting the sequence. The radio beeps each time the sequence recycles.

A final circuit is shown in Fig. 5. The components chosen provide a pulse rate between 11 and 68 Hz, which represents a 110-to-680-Hz-per-second scan range. In other words, the radio will scan a 40-kHz bandwidth in 65 to 370 seconds, depending on the scan-speed setting.

To program the scanner, a five-position 4-pole switch was handy and was pressed into service (Fig. 6). The scan widths programmed were 10, 20, 40, 80, and 325 kHz. 10 and 20 kHz are useful for looking for a schedule; 40 and 80 kHz can be used to monitor a complete band segment (i.e., advanced section of 20). Most of the international broadcast bands are between 200 and 350 kHz wide, so 325 kHz is a good compromise (13- through 60-meter bands).

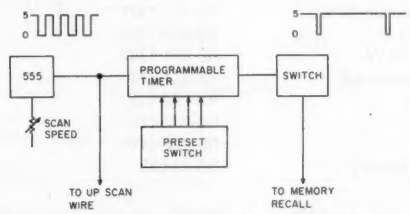


Fig. 4. Block diagram of final circuit.

The unit is at the left, front view.

Now for the bad news. (The news you suspected but did not want to admit.) The radio has to be slightly modified. To ease the pain, this modification adds only one wire. Unplug the radio and remove the top and bottom covers. Keep the radio right side up and refer to Fig. 7. If you do not have the automatic antenna tuner installed, you will easily see where you must attach the extra wire. At point X or Y, tack-solder an insulated small-gauge wire. The other end of the wire must reach the microphone connector, so leave it long. If the antenna tuner is installed, as mine is, you may want to remove it—or just reach in carefully with a small low-wattage iron and tack-solder the wire to the back of the memory-recall switch, as above.

With an ohmmeter, check between the unsoldered end of the wire and the case of the radio (ground). Verify that a short is obtained when you press the memory-recall button.

Next, snake the wire to the bottom of the radio, turn the radio over, and attach the wire to one of the two unused contacts on the microphone connector. That is the extent of the modification to the radio.

The circuit is built in a small Bud box and placed next to the radio. Three wires must be added between the microphone con-

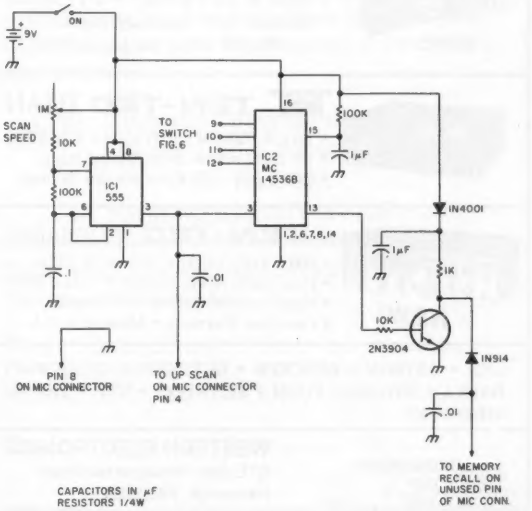


Fig. 5. TS-930S scan circuit.

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nector and the scan box. They are ground, scan-up, and memory recall. Shielded wire is recommended.

The unit is powered by a 9-V transistor-radio battery and, due to the low current drain, I expect long life.

The complete circuit could have been built inside the radio, under the VOX access door on top of the radio, using the radio power. This would have been an extensive modification and I did not feel it was necessary. This circuit could also be built into a microphone stand.

I have found this modification most useful. For example, I keep a weekly schedule with Lowell W2HXJ. We meet around 14.260 MHz, plus or minus. I set the scan width to 20 kHz, preprogram the memory for 14.250, and turn the scan on. I set the scan speed to sweep through 20 kHz in about 45 seconds. I haven't missed Lowell yet, and I do not have to be near the radio to hear him call!

The circuit is simple, and the only expensive part is the programmable timer, which lists for approximately $11.00. ■

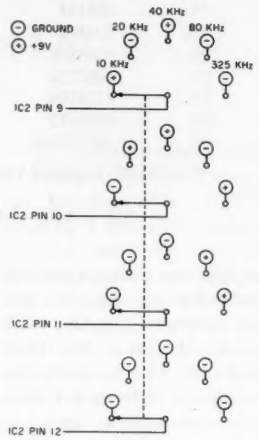

Fig. 6. Preprogrammed switch.

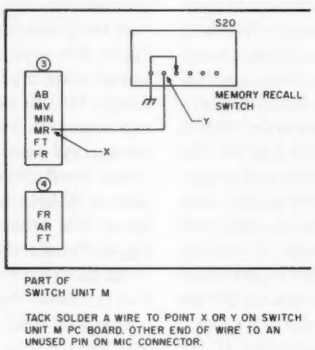

Fig. 7. Part of switch unit M.

Part List

1—555 timer	Radio Shack 276-1723	$.99
1—MC14536B Motorola	Motorola Distributor	11.00
1—2N3904	RS 276-1603	.14
1—1N4001	RS 276-1101	.25
1—1N914	RS 276-1122	.10
1—1k resistor, ¼ W	RS 271-1321	.08
2—10k, ¼ W	RS 271-1335	.16
2—100k, ¼ W	RS 271-1347	.16
1—1-megohm pot	RS 271-211	1.09
2—.01 uF	RS 272-131	.39
1—.1 uF	RS 272-135	.25
2—1 uF	RS 272-1419	.49
1—9-volt battery	RS 23-553	2.19
		$17.29

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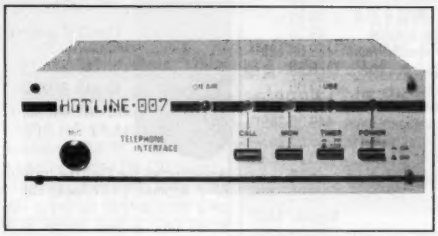

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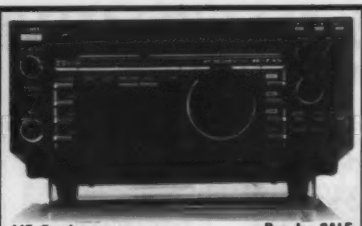

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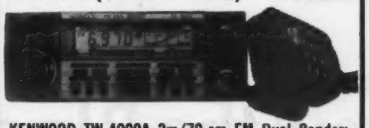

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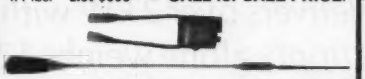

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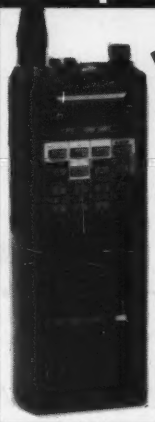

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In a heroic effort, WB2WIK has created the ultimate 6-meter amplifier. Its single 4-1000A delivers over 2 kW with only 20 Watts in. The power supply alone weighs 120 pounds. When this monster talks, people listen!

Photo A. The six-meter Blockbuster.

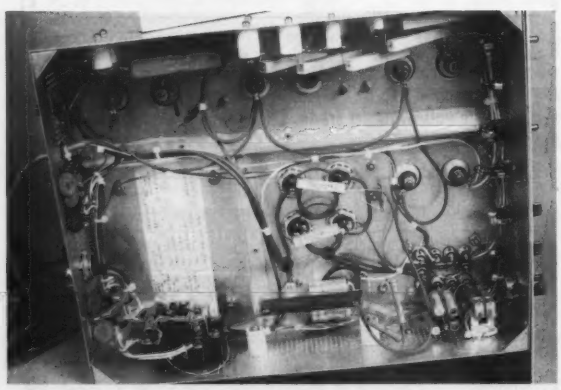

Photo B. Power supply, bottom view.

Although I enjoy rag-chewing, DX-chasing, contesting, satellite work, and just about every conceivable aspect of amateur radio, the activity I enjoy most of all is home-brewing, especially home-brewing with a purpose. This article describes a reasonably ambitious effort which was precipitated by a very distinct purpose: I wanted to become more competitive in VHF contests, especially on the 50-MHz band where a few more dB could add multipliers via meteor scatter when band conditions are less than perfect. I call the result my "Blockbuster."

I had been using a rather modest kilowatt amplifier on six meters, a single 4CX350A at about 600 Watts PEP output, and I wanted to QRO right to the legal limit of 1.5 kW PEP out. While this is only about a 4-dB increase in signal, I reasoned that it would be the most important 4 dB of all, especially in contests where scatter-mode communication is very important for added multipliers. I toyed with the idea of using such exotic tubes as 8877s, 4CX1500s, or possibly the new Eimac 3CX800, but dismissed these as too expensive or, in the case of the 8877, too hard to drive. I really wanted a legal-limit amp which could be driven with today's solid-state multimode rigs (perhaps 20 Watts PEP output) and which used an inexpensive, obtainable tube. Hmmm...what about the old, reliable 4-1000A?

For the uninitiated, the 4-1000A is a workhorse tetrode that has been around forever and is usable to 110 MHz despite its overwhelming stature (about nine inches tall, five inches in diameter). The plate dissipation rating is 1000 Watts and the tube can be operated in grid-driven class AB_2 service at well over the legal power limit with only 20 Watts drive. Not only that, the real charm of the 4-1000A is its availability at reasonable cost. This is a very popular broadcast-service tube and "pulls," which still will deliv-

er 1500 Watts PEP output, are offered at flea markets for about $50 to $100, a far cry from the price tag on an 8877.

My desire to operate the project amplifier in grid-driven rather than grounded-grid service was the result of careful investigation of the parametric trade-offs. A grounded-grid 4-1000A, certainly an easier amp to build, requires over 100 Watts drive and *might* deliver 1500 Watts PEP output, while a grid-driven circuit, obviously more complex, only requires 20 Watts drive and should deliver 2000 Watts PEP output easily!

Not one to flaunt all this power, especially in a national magazine probably read by FCC staffers, I'll just say that I reasoned a 2-kW+ amplifier should really sound good and should last a long time when run at the reduced legal limit of 1500 Watts.

I built the power supply first. This is a matter of personal preference, but I strongly recommend that anyone attempting this project follow my lead and tackle the power supply right off. The power supply is going to be very heavy and a mighty pain in the neck to assemble largely because of its muscle-building bulk, and if you don't finish this half of the job at the start, you might never get to it.

My power supply is actually three power supplies built on a single chassis measuring 17" × 13" × 4" and then bolted to a 12" × 19" rack panel. The aluminum chassis has perforated side walls to enhance air circulation beneath, and it wouldn't have been strong enough to support all the transformers and capacitors if I hadn't first given it additional support by means of some 3/4" aluminum angle stock riveted under the whole length and half the width—see Photo B. (My thanks to WA2VUN and W2HWG who did much of the aluminum punching, riveting, and welding on this project.)

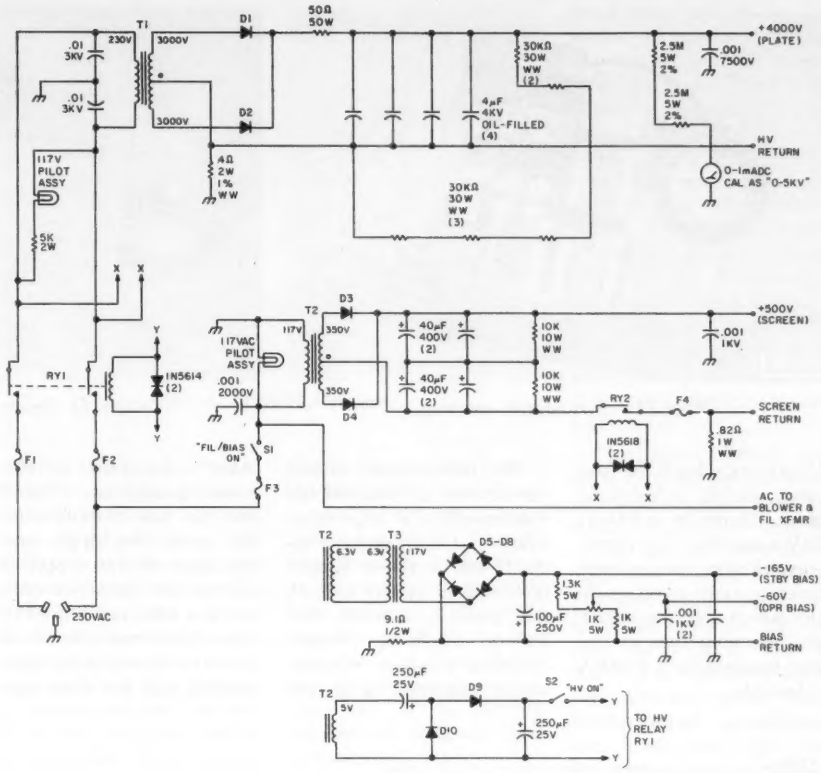

Fig. 1. Power supply.

After the power supply was completed, I added more 3/4" aluminum angle stock between the rear of the chassis and the back side of the panel to add support and also to give me a place to grab when attempting to lift this turkey! My supply weighs 120 pounds, but possibly yours can be somewhat lighter if you choose less bulky components.

Because I know the 4-1000A is both voltage- and current-hungry, I designed the plate supply to deliver 4000 volts at one Ampere. This may sound like overkill, and maybe it is, but I wanted this thing to last through a lot of contests. I bought a Hypersil transformer from the Peter W. Dahl Company (El Paso, Texas) for something over $200. Its ratings are 6000 volts center-tapped at 800 mA CCS, and it weighs about fifty pounds. Careful shopping at flea markets might possibly turn up something similarly rated for less money.

I run the plate supply as a full-wave center-tap using two 7500-volt, 2-Amp rectifier stacks and 16 uF of filtering (4 each, 4 uF at 4 kV). The high-voltage capacitors are large but weren't expensive—obtained from Fair Radio Sales (Lima, Ohio) via mail order. The plate-supply bleeder is a bank of five 30k-Ohm, 30-Watt wire-wound ceramic resistors mounted on ceramic standoffs. The plate transformer, needless to say, is supplied by a "stiff" 230-volt-ac line and the primary is dual-fused (each side of the 230-volt line) with 20-Amp slow-blow fuses and switched with a 25-Amp DPST relay.

The screen supply delivers 500 V dc at 100 mA and is so stiff it requires no additional electronic regulation. I used a multi-winding transformer obtained from Fair Radio Sales. The 700-volt center-tapped secondary drives a full-wave (center-tap) rectifier circuit followed by a 70-uF filter and a 20k-Ohm bleeder and delivers almost exacty 500 volts of low-ripple dc. The screen transformer center-tap is also relay-switched to ensure that the plate supply is on *before* the screen supply. Catastrophic results are likely otherwise.

The power supply also contains the grid-bias supply, which delivers two output voltages: −165 V dc for standby and −60 V dc, adjustable plus or minus 20%, for operating. I derive the bias from a full-wave bridge rectifier driven by a 6.3-V filament transformer which is wired back-to-back across a 6.3-V-ac winding of the screen transformer. The

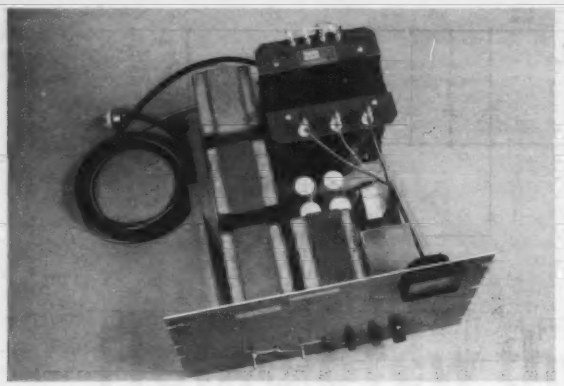

Photo C. Power supply, top view.

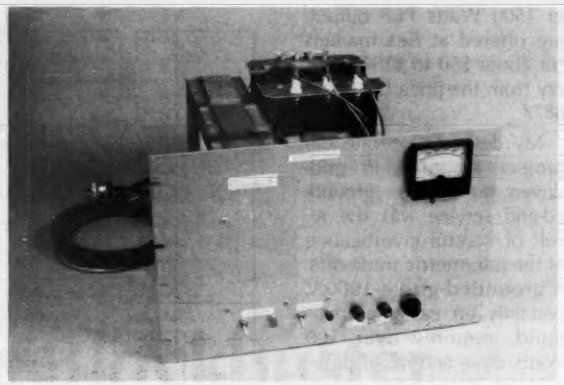

Photo D. Power supply, front view.

117-volt-ac drive to the bridge yields −165-V-dc output, filtered by a 100-uF, 250-V capacitor. The bleeder-resistor-string values were chosen to make a voltage divider which sets the adjustable operating bias in the range required for a 4-1000A in class AB_2.

The high-voltage (plate) transformer is switched (as mentioned) by a large relay whose coil is driven by a little 12-volt-dc power supply built into the system for just this purpose: I made this 12-V-dc supply by voltage-doubling a 5-V-ac winding which happened to be another secondary of the screen transformer (I told you this was a multi-function unit!). The ripple and regulation of this supply is unimportant since its only load is a relay coil. I use the plate-transformer primary to drive the screen relay, thus ensuring that the plate supply is on before the screen supply. This is a good safety measure because tetrodes get very excited about having screen voltage before plate voltage (it destroys the screen).

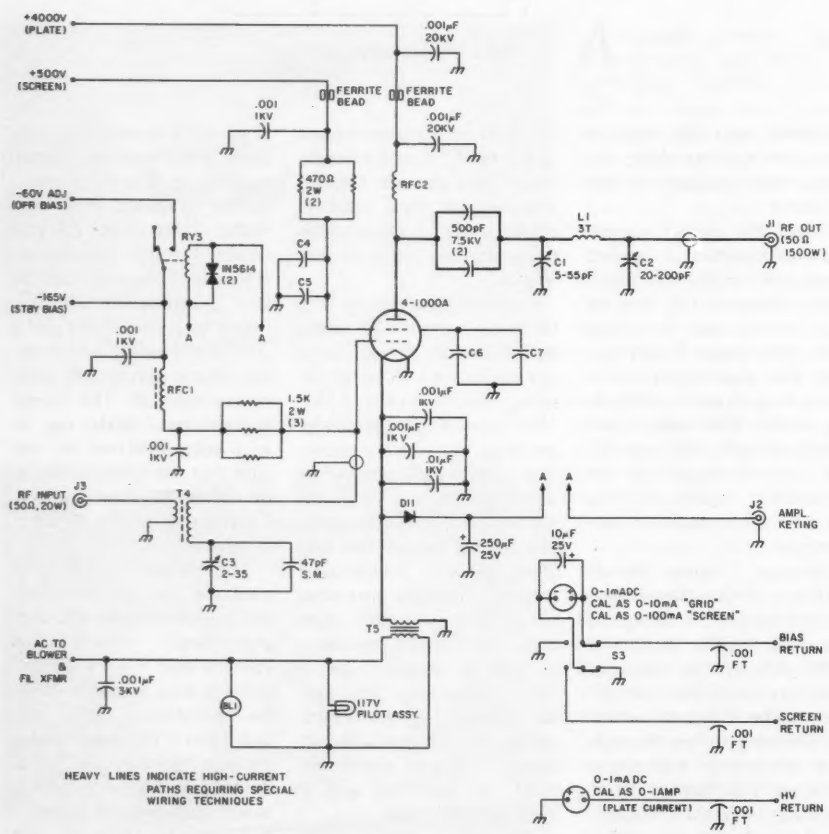

Fig. 2. Rf deck.

My supply has a built-in plate voltmeter (0–1-mA-dc meter driven by a series-multiplier string of five one-megohm resistors) which reads 0–5000 volts dc. This is a useful scale since the key-up voltage is 4500 V (key-down is about 4100 V). The supply also contains shunts for plate-current, screen-current, and grid-current meters which are mounted on the panel of the rf deck. These are all indicated on the schematic diagram for the power supply (Fig. 1).

I also have a "keyed" 117-V-ac output line coming from the power supply to the rf deck to run the deck-contained blower, filament transformer, and pilot lamp. The power supply contains two pilot lamps (ac on and HV on) plus several fuse assemblies. All ac inputs, ac outputs, and dc outputs are bypassed with suitable ceramic capacitors as indicated on the schematic. The 4-kV plate-supply output is bypassed with 7.5-kV "doorknob" capacitors since not many other types will withstand this kind of voltage continuously.

At this power level, even the ac line cord must be se-

lected carefully—I used a #12-4 cable. A smaller cable will have too much IR drop. Remember, this is a 4000-Watt power supply! I run the switched ac and all low-voltage dc lines through a 12-conductor cable to a Cinch-Jones-type power connector which mates with another connector fitted to a similar cable coming from the rf deck. The HV output line is made of 20-kV anode cable fitted with a male Millen-type high-voltage connector at each end.

The completed power supply is not a table-top unit by any means, but it is quite compact for its capability and is attractive enough. The commercial look is imparted by careful construction and good overall workmanship. Wire dress, especially at the 4-kV level, is very important! All plate-supply secondary wiring is 20-kV insulated anode wire.

The rf deck is straightforward. I designed the plate tank circuit for a Q of about 16. A lower Q is not possible with the 4-1000A at 50 MHz because of the tube's high plate capacitance. The tank circuit, a conventional pi network, uses a Jennings vacuum-variable input-tuning capacitor, type GCS-55, a coil made of ¼" copper tubing (3 turns, 1¾" inside diameter, 3¼" long) and a 200-pF air-spaced variable-output capacitor made by E. F. Johnson (type 167-12). The Jennings plate-tuning capacitor is rated at 7500 volts, and this is a recommended unit. It has high Q and very low minimum capacitance, which is required at this frequency. If a Jennings unit cannot be found at reasonable cost, I'd recommend a Millen-type 15011 neutralizing capacitor with 2¼"-diameter plates as a second choice. The object here is high Q and very low minimum C in order to obtain a reasonable overall Q. An ordinary air-spaced variable multi-plate capacitor won't work.

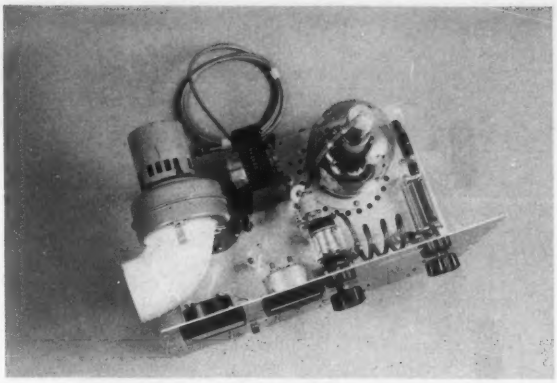

Photo E. Rf deck, top view.

While chassis size for the rf deck is certainly not critical, the deck must be fairly large simply because the 4-1000A is so darned big! My chassis measures 10" × 17" × 4" but could be slightly smaller if the blower were mounted totally outboard. I used an Eimac SK-510 socket, but this shouldn't be critical, as any air-system socket will work fine. These sockets do *not* contain any special screen-bypass capacitor and are of simple construction and low cost. While Eimac and others recommend the use of a glass chimney for the 4-1000A, I didn't use one. Instead, I punched 24 5/16"-diameter holes in a circle pattern around the outside of the socket rim (see Photos E and F) and forced a lot of air through the socket and these holes, thus creating a considerable draft along the tube envelope. The blower I selected was a Dayton 2C781 (Photos E and F), but any similar or larger blower will work. The object, obviously, is to force a *lot* of air through the tube base and around the envelope. The more air, the better! I also used a large (1-3/8" diameter) finned aluminum-plate cap on the tube to help reduce plate-seal temperature.

Since the rf deck chassis must be pressurized, use one with solid, not perforated, walls. Also, be sure to seal any cracks or holes with RTV caulking compound to help maximize pressurization of the under-chassis.

My rf deck has the filament transformer mounted atop the chassis between the blower and the tube. It might be wiser to mount the transformer below the chassis, as the heat radiated by the 4-1000A adds to the operating temperature of the transformer. I used a filament transformer from Amp Supply Company (Twinsburg, Ohio), type X7.5-21, which cost about $50. I also obtained several other components, like some 7500-V doorknob capacitors, panel meters, etc., from Amp Supply. Since the 4-1000A filament drain is very high, the wiring must be kept short and the conductor size large. I used #12 insulated wire routed directly to the tube socket.

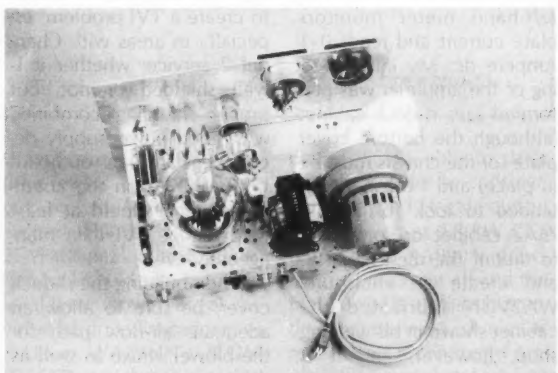

Photo F. Rf deck, top/rear view.

The input-circuit and plate rf-choke designs were borrowed originally from an *ARRL Handbook* article written around a 4CX1000A amplifier for six meters; however, both items required modification for use with the 4-1000A. The 4-1000A and 4CX1000A, while very different tubes, have similar input capacitance and I reasoned that the *Handbook* circuit would work. It didn't, and I modified both the tuning capacitance and the grid-load resistance to accommodate the 4-1000A characteristics. These revisions are noted in the rf-deck schematic diagram (Fig. 2). Having built other VHF high-powered amplifiers, I already knew something about plate rf chokes and the *Handbook* design, using a 1"-diameter Teflon™ form, looked good. It worked, but flamed out after a few hours of operating time. I rewound the plate rf choke using #20 enamel wire on the same Teflon form and so far this choke has lasted. It is likely that the combination of very high rf voltage across the choke, the considerable dc current through the choke, and its very high ambient temperature (the result of its being located close to the 4-1000A envelope) caused the demise of the original component—which was wound with #24 wire.

The input circuit, shown in both photos and figures,

centers around a single T50-12 ferrite toroid transformer. I obtained both this toroid form and a supply of ferromagnetic beads for decoupling purposes from Amidon Associates (North Hollywood, California), who are very nice people to work with and offered me overnight delivery at reasonable cost.

The plate-blocking capacitor is actually two paralleled 500-pF, 20-kV doorknob units made by Sprague and purchased at a local flea market. The 20-kV rating is unnecessary, but I'd strongly recommend the doorknob design; other types of capacitors just can't handle all the rf current.

The output-circuit configuration and mounting is straightforward as pictured in Photo F. The Jennings vacuum capacitor mounts on three aluminum spacers directly to the front panel, while the tank inductor and loading capacitor mount on ceramic spacers to the chassis. Interconnections between all plate-circuit components are made with copper braid taken from high-quality RG-8/U coaxial cable. The connection from plate tank to the rf-output connector, a type-N receptacle, is made with high-quality RG-8/U routed as far away from the tube envelope as possible to avoid overheating. After all, with this amplifier at maximum output, the rf voltage across the 50-Ohm output cable is about 450 volts peak when the output load swr is 1:1 and can become considerably higher at elevated vswr. The output current is also high in this legal-limit amplifier: About 6.5 Amperes rms will be conducted in the output cable. Needless to say, RG-58/U—even in very short lengths—is *not* recommended!

I used knobs from an old Heathkit SB220 for the plate tune and load controls. The front panel of the rf deck would look a bit boring with just two knobs, so I fancied it up a bit with a pair of 3¼" panel meters, a meter switch, and a red pilot-lamp assembly to indicate the "on" status of the remote power supply. The right-hand meter reads 0–10 mA dc for grid current and 0–100 mA dc for screen current and is switched with the toggle switch mounted directly below the meter. The left-hand meter monitors plate current and reads 0–1 Ampere dc. My initial testing of the amplifier was performed *sans* rf-deck cabinet (although the bottom cover plate for the chassis must be in place) and I originally intended to look for an old 75A2 cabinet or something to mount the rack panel to and create an enclosure. WA2VUN fabricated the cabinet shown in his welding shop, however, and it is quite functional.

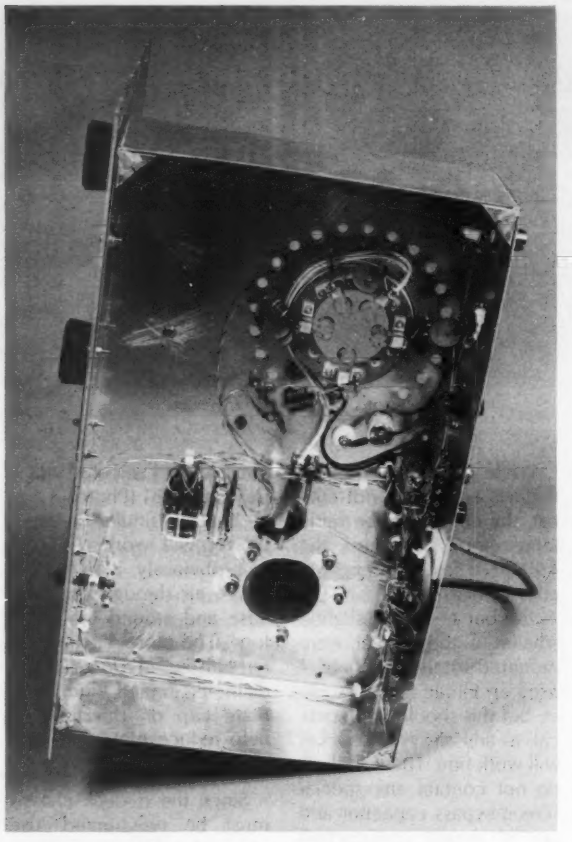

Photo G. Rf deck, bottom view.

A *large* hole must be punched in the cabinet above the 4-1000A to allow free escapement of the cooling air which is forced past the tube. This hole should be at least five inches in diameter and centered directly over the tube. The ventilation hole should be covered with window-screen material or the like to aid in shielding. This amplifier is bound to create a TVI problem, especially in areas with Channel 2 service, whether it is well shielded or not, but proper shielding combined with good power-supply decoupling and an outboard low-pass filter in the antenna feedline should at least help reduce TVI to a manageable level.

When building the rf-deck cover, be sure to allow an adequate air-flow path for the blower *intake* as well as the exhaust. Mine is ducted from the side of the cabinet away from the tube to ensure a plentiful supply of cool intake air. While an outboard blower would solve this problem, I intended the deck to be as self-contained as possible without occupying too much depth on the operating bench; I mounted the blower on the rf-deck chassis and ducted the air intake to the cabinet side wall using an elbow made of 3" (inside diameter) PVC tubing.

My first attempt at putting this monster on the air revealed a few weak links, some of which I discussed earlier. One weak point not yet mentioned is the grounding strap which connected the rotor of the plate-loading (output) capacitor to chassis ground. I had built this strap of RG-8/U braid which was soldered to a rotor lug on the 200-pF capacitor and bolted to the chassis. After a few minutes of key-down operation at about one kilowatt output, the solder bonding the braid to the rotor lug melted, disconnecting this ground point and throwing the tank circuit out of resonance. Apparently there are some real hefty circulating tank currents in this amplifier (partially due to its high Q) and solder was not going to do this job!

Adding a parallel ground path, using some .031"-thick aluminum-sheet material, *bolted*, not soldered, between the capacitor rotor connection point and the chassis solved this problem. I bent some sheet aluminum to make a bracket-like assembly and punched it to accommodate the load-capacitor shaft bushing (which is electrically common to the rotor) and then bolted this assembly to connect the capacitor rotor to the rf-deck chassis. This seems to have permanently solved the ground-braid overheating problem.

At this point, I was able to drive the Blockbuster to a good, solid 1500 Watts rf

Parts List

Note: Unless otherwise specified, all resistors are 1/2 Watt, 10%; all capacitors of less than 1 uF are disc ceramic, 1000 Volts. Many values are not critical and may be substituted, as discussed in the text. Other key components are discussed in the text.

BL1	Centrifugal "squirrel-cage" blower	Dayton P/N 2C781 or equiv.	$20
C1	Plate-tuning capacitor	ITT/Jennings P/N GCS-55 or equiv.	$15 surplus $100 new
C2	Plate-load capacitor	E. F. Johnson P/N 167-12 or equiv.	$5 surplus
C3	Input-tune capacitor	All-Star Products P/N APC-5814 or equiv.	$5.95 new
C4–C7	Screen-bypass capacitor	Centralab P/N DD30-102 or equiv.	59¢ each new
D1, D2	HV rectifier assembly	Semtech P/N SCHS7500 or equiv.	$54.74 each new $10 each surplus
D3–D11	Rectifier, 1000 piv, 1 A	Semtech P/N 1N5620 or equiv.	$1.51 each
F1, F2	Primary line fuse	Bussmann MDL20 or equiv.	25¢ each
F3	Screen/bias/blower fuse	Bussmann MDL5 or equiv.	25¢ each
F4	Screen center-tap fuse	Bussmann AGC1/8 or equiv.	80¢ each
J1	Rf output receptacle, Type N, Mil type UG-58A/U	Amphenol P/N 82-97 or equiv.	$3.29 each
J2	Keying receptacle, RCA phono type		20¢ each
J3	Rf input receptacle, UHF type, Mil type SO-239	Amphenol P/N 83-1R or equiv.	89¢ each
L1	Plate tank coil, 3 turns 1/4" copper tubing wound on a 1-3/4" form (which is then removed), 3-1/4" long		Home-brew $1
RFC1	2.5-uH, 1-Amp choke	J. W. Miller P/N 4606 or equiv.	$1.95
RFC2	36 turns #20 enameled wire on 1"-diameter Teflon™ rod		Home-brew $5
RY1	DPST or DPDT relay (plate supply primary), 20-Amp, 230-V-ac contact ratings	PRD P/N 7DY0 or equiv.	$12.95 new
RY2	SPST or SPDT relay	P&B P/N KA5AG or equiv.	$5.95 new
RY3	SPDT or DPDT relay	P&B P/N KA11DG or equiv.	$6.95 new
S1, S2	SPST or SPDT toggle switch	Cutler-Hammer P/N 7580K7 or equiv.	$1.59
S3	DPDT toggle switch	Cutler-Hammer P/N 7591K6 or equiv.	$1.79
T1	HV (plate) transformer, 230 V ac: 6000 V ac center-tapped, discussed in text.		$230 new
T2	Multipurpose transformer, 120 V ac: 700 V ac center-tapped, 6.3 V ac and 5 V ac	Fair Radio P/N T52960 or equiv.	$5.95 (surplus)
T3	Filament transformer (used for bias), 120 V ac: 6.3 V ac @ 2 Amps	Stancor P/N P6466 or equiv.	$6.95 new
T4	Rf input transformer (toroid), 2 turns #24 enameled wire primary, 10 turns #24 enameled wire secondary, wound on a T-5-12 core. Observe winding polarity.		Home-brew $1

output into my 50-Ohm Bird oil-cooled dummy load. The exciter power required for legal-limit output is only 25 Watts, yielding an amplifier power gain of 60. This amplifier is very linear, so the 60:1 power gain remains nearly constant over a wide range of driving powers; e.g., 20 Watts drive yields 1200 Watts output, 10 Watts drive yields 600 Watts output, etc. My own six-meter exciter achieves only about 25 Watts peak output, so my station is held down to the legal-limit power level by virtue of drive limitations.

Using WA2VUN's ICOM IC-551D, which can develop about 80 Watts peak output power, I was able to drive the Blockbuster to considerably beyond legal output power. Even at 1.8 kW CCS output, the 4-1000A draws no grid current at all and the plate color is a bright but entirely reasonable shade of red. I don't recommend running this power level for two very good reasons: (1) It exceeds the plate dissipation rating of the 4-1000A—and this will undoubtedly shorten operating life—and (2) it is illegal.

This is the point where authors of amplifier articles start weaving tales of "strongest signal on the band" reports received. Not to change fifty years of convention, I'll report that my local contest club, SCORE (the Society of Contest Operators and Radio Experimenters), using the callsign K2XR from Western New York, used the Blockbluster on six meters during our operation in the ARRL June VHF QSO Party (1984) and we *never* had to call anybody twice! We did indeed receive many "strongest signal on the band" reports and did not receive a single report of splattering, distortion, or any similarly discouraging words. We used an IC-551D exciter and a pair of 7-element KLM yagi antennas at sixty feet, thus developing about 54 kilowatts effective radiated power (taking feedline loss into consideration). With this setup, we worked numerous meteor-scatter contacts with a very high level of success. Eureka! My goal, stated in the very first paragraph of this article, was achieved.

I might mention that once you've built the power supply for the Blockbuster, it becomes the foundation on which to build various other high-powered rf decks. My next project probably will be a legal-limit 160-meter monoband amp using another 4-1000A. The supply described in this article is super. Reasonably small and affordable, it delivers all necessary operating voltages for a wide variety of high-powered triodes or tetrodes.

Thanks to KT2B for the excellent photographic work and, as mentioned earlier, to WA2VUN and W2HWG for sheet-metal fabrication.

CU on six! ■

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Broken Ox Blues

The grid-dip oscillator is a stellar performer, but missing coils can mean big headaches. Avoid frustrations by winding your own.

Although the grid-dip oscillator has been around the laboratory for a long time, Heath introduced it to the general public at a reasonable price in the early 1950s. While the lab models helped scientists find the resonant frequency of tuned circuits, the average amateur still had to "cut and try" as the price kept the instrument out of his reach. Despite some limitations, the ubiquitous Heathkit™ GD-1 and its successors have helped amateurs tune countless transmitters, receivers, and filters.

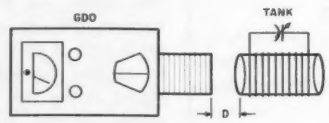

Fig. 1. Typical setup for finding resonant frequency of unknown tank circuit. Meter suddenly "dips" as circuit is tuned to oscillator frequency.

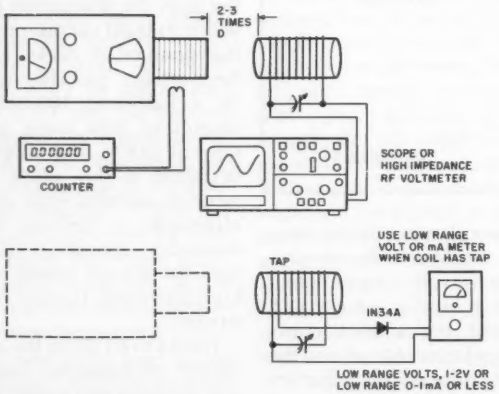
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Fig. 2. An improved setup allows more distance between gdo and tank, giving improved accuracy. External indicator is free from the gdo's internal spurious responses.

Regrettably, the coils get broken, the manufacturer can't supply parts for the early models, and the meter then gets shelved or even discarded.

Well, one of those discarded units fell into my outstretched hands and I couldn't wait to fire it up. I took it apart to cement the knob back together and see if the tube was still in place. A quick check with a random-length piece of wire in the coil socket proved that the tube had survived in good condition. A little cleaning up had the gdo ready for action. Then I found out why someone had tossed it out: No one could supply coils or forms. I thought surely someone would know where I could get a set of coils. The best information that I got consisted of instructions on how to use a lathe.

Well, the original coils did have a tendency to work themselves loose at inopportune times, so why not try a "new and improved" coil system? The photos show what happened.

Plastic 35mm film cans and the now common F connectors seemed like a good combination. Many amateurs play with photography or know someone who does. That can give an instant supply of coil forms, forms which "machine" with little effort. The F connectors cost a bit more than the forms, but many times they can be salvaged from old equipment.

The higher-frequency coils up to over 200 MHz need little effort to construct. A piece of brazing rod about three inches long formed into a hairpin loop gives the highest frequency range and is self-supporting. The other two self-supporting coils take the oscillator down to about 20 MHz. The lower-

frequency coils take a bit more effort but are worth it. You can make overlapping ranges down below 200 kHz, although I stopped around 250 kHz as I have another oscillator for that range.

Drill the center of the form for the connector but don't put it in yet. Punch a couple of holes near the top of the form and thread one end of the wire into it. Leave two to three inches of wire inside the form. Wind on the number of turns that the table or your intuition suggests and punch a couple of holes for the other end of the wire. Put a washer and mounting nut on one wire, then poke it through the center mounting hole. Solder it to the center of the F connector. Push the F connector up into the mounting hole and fasten the nut to it.

Make a hole in the bottom of the coil form and run the other wire out to the connector. If you solder directly to the fitting rather than using a solder lug, be sure to scrape the plating off first so that you can make a quick, solid connection with a hot iron. That keeps the plastic coil form from melting.

The low-frequency coils below about 2 MHz need a center tap which has to go to ground. I simply brought out a long flexible lead from the coil and let it float (note Photo C). Scramble-wind these coils in order to get the most inductance with the least distributed capacitance. That will give the widest possible frequency change with the nominal 70-pF tuning capacitor. As the photo shows, even the lowest coil that I wound gives a 50-kHz range.

I found it helpful to write the measured frequency on the coil. Since I had access to an LCR meter, I put the inductance on the coil too. That is useful when using the coils as reference inductors.

I used an old rod antenna for the coil that covers the upper half of the broadcast band. That one puts out a good, hot signal.

As Photos D and E show, the gdo itself needs very little modification. Start by removing the cover and the two screws that hold the coil socket in place. Carefully unsolder the three socket leads. Remove the socket and take it apart. It has two pieces of bakelite sandwiching the connections. Remove the *bottom* layer and the connections. Ream the top section out so that it will hold the F connector. Insert a washer or flattened piece of large-gauge wire under the nut on the bottom of the assembly. Tighten it down. Solder a strap or another piece of flattened wire to the center conductor. Align the two connections with the areas on the variable capacitor where the original connections were, and solder them in place. Excessive heat may damage the variable cap, so use enough heat to get the job done quickly. Put the two mounting screws back in place.

You may want to put a small bolt through the top cover for grounding the cen-

Photo A. By adding an F connector and winding coils on plastic film cans you can recycle older grid-dip meters when you can't get the original coils.

Photo B. Some of the HF and VHF coils (going up to over 200 MHz).

Photo C. Some of the LF coils. The antenna-rod coil gives high output but takes innovative engineering to mount the F connector.

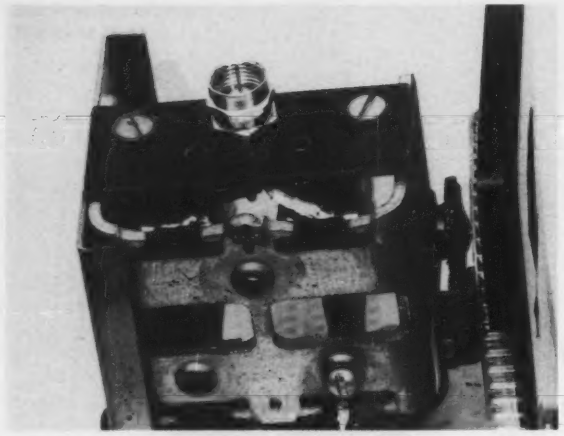

Photo D. Interior view showing connection detail.

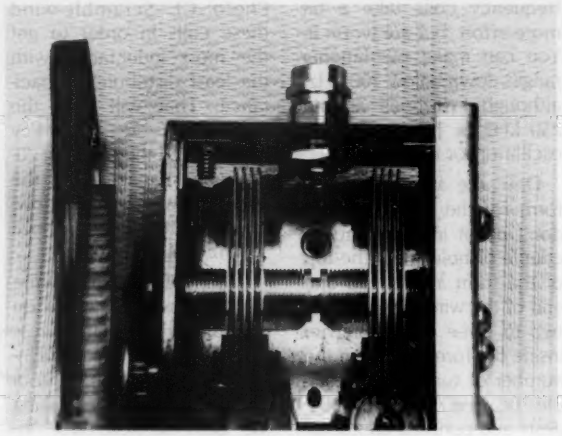

Photo E. Close-up showing assembly detail.

ter tap on the LF coils. While you have the gdo apart and *if* the knob is still in one piece, you may want to put a new scale on the tuning indicator. If you need only a few ranges, they should fit. If you use many overlapping ranges like I did, then a logging scale (say 1–20) would be good. Of course for more than ball-park measurements a counter will pick up some of the signal and give you direct readout. When you finish the calibration, put the cover back on and you are ready to pre-tune networks or measure stray tanks dug out of the spare-parts box.

Although the photos don't show it, you can get an adapter that screws into the socket and gives you the convenience of plug-in coils. The few pFs that it adds show up mostly on the higher frequencies. It does save a lot of time while running down a tuned circuit.

Although the books give the theory of operation, perhaps a quick word here on the practical applications would be in order. In the typical setup shown in Fig. 1, the gdo and the unknown tank are placed near each other. The oscillator frequency is varied until the meter gives a strong indication, usually a dip. Then the tank is moved farther away and the operation is repeated. The dip will be sharper and, therefore, the frequency measurement will be a bit more accurate.

Many times you can get a better tuning indication that is free from the gdo's internal spurious response by using the setup shown in Fig. 2. An *external* instrument tells you when the gdo and the tank are tuned to each other. A high-impedance voltmeter or an oscilloscope work well. The capacitance they add can usually be compensated for once you have the ball-park measurement.

A germanium diode and a low-range voltmeter or mA meter can come close to duplicating actual circuit conditions and give very good results. Again, the tank and the dipper may be separated by a moderate distance and still give easy-to-see, sharp, tuning peaks. A 1N34A or 1N82 works well up to 200 MHz and above. A 0–1-mA meter or your voltmeter's lower range serves as the diode load and the indicator. I would shy away from digital meters because the time they take to sample and give a change in the readout could let you tune past the peak, unless you tune *very* slowly. Additionally, due to their high-input impedance, they would need about a 10,000-Ohm resistor shunted across the input terminals to provide a more or less proper load for the diode.

You can use a 3–5-turn air-wound link near or over the cold end of coils that don't have a built-in tap or link.

Even if you don't have an older instrument waiting for a new set of coils, you can use these techniques with the more modern models for easier, faster tweaking. ■

COIL TABLE

Tuning Range**	Inductance	Wire Size Awg #	Number of Turns	Center Tap	Scramble Wind
244–300 kHz	6.3 mH	32	Lots*	Yes	Yes
344–530 kHz	2.44 mH	32	Lots*	Yes	Yes
508–900 kHz		32	Lots*	Yes	Yes
640–1200 kHz	750 μH	32	Lots*	Yes	Yes
965–1750 kHz	318 μH	32	Lots*	Yes	Yes
1.1–2.6 MHz	322 μH	32	Full form	Yes	Single layer
1.7–5 MHz	115 μH	26	Full form	No	Single layer
2.8–7.7 MHz	39 μH	26	37	No	Single layer
4.4–12 MHz	18 μH	22	26	No	Single layer
10–26 MHz		22	8	No	Single layer
26–70 MHz		22	11	No	Single layer
80–205 MHz		Brazing rod	Hairpin loop		

*As a starting point for the low-frequency coils, wind one with 100 turns with center tap and tack it together. Then measure the frequency and go from there. Twice the number of turns will give about four times the inductance and about one half the frequency.

The 26–70-MHz coil is wound on a ¼" diameter form. It is next to the 200-MHz hairpin loop in Photo B.

**A ¼" wide copper strap about ½" long formed into a loop will get the oscillator up to 250 MHz, but the oscillator may drop out around its low end, 100 MHz.

Inductance measurements are not available on some coils.

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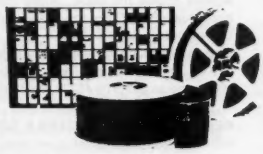

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SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

HELEN KELLER ARTS FESTIVAL
JUN 29

The Muscle Shoals Amateur Radio Club (W4JNB) will be active from 1600 UTC to 2300 UTC, June 29, 1985, from the Helen Keller Arts Festival in Tuscumbia AL. For a special-event certificate, send a large SASE to PO Box 2745, Muscle Shoals AL 35662-2745. There will be phone and CW operation on the 80-, 40-, and 20-meter General bands. For further information, contact Dyer N. Ruggles KA4JWD, 116 Hiwassee, Sheffield AL 35660.

BRESSLER PA
JUL 4

The Harrisburg RAC will sponsor its annual Firecracker Hamfest on July 4, 1985, at the Bressler Fire Company picnic grounds, near Exit 1 of I-283 at Route 441; follow the signs to Bressler. Three motels and several restaurants are located at this exit. Admission is $3.00, with XYLs and kids free. There is no charge for tailgating. VE exams will be given. There is parking for 1000 cars. For more information or for table reservations, contact Dave KC3MG, 131 Livingston Street, Swatara PA 17113; (717)-939-4957.

FORT LARAMIE WY
JUL 4-5

The High Plains ARC will operate K7YPT from 0000 UTC on July 4, 1985, through 0000 UTC on July 5, 1985, at historic Fort Laramie. Frequencies will be: phone—3.850, 7.250, 14.300, 21.360, and 28.550; CW—50 kHz up from the lower band edge. For a QSL, send a business-size SASE to K7YPT, PO Box T, Torrington WY 82240.

USS NAUTILUS
JUL 4-6

The *Nautilus* comes home! The world's first nuclear submarine, the *USS Nautilus* (SSN-571), is returning to the Submarine Base in New London CT, where it will be put on permanent public display while remaining commissioned. The Submarine Base station, K1SSN, will be operated as a special-event station on July 4, 5, and 6, 1985, to honor the *Nautilus'* return on July 5. Members from the K1SSN Club Station, Tri-City ARC, RASON, and SCRAMS will operate K1SSN from 1400 UTC to 0100 UTC on each of the three days. Look for K1SSN in the lower 20 kHz of the 80-10-meter General-class bands, phone and CW, and the center of the Novice bands. QSL via Tri-City ARC, PO Box 686, Groton CT 06340. For further information, please contact Bob Dargel KA1BB, 8 Willow Lane, East Lyme CT 06333; (203)-739-8016 or (203)-446-7325 (business).

RAPID CITY SD
JUL 5-7

The Black Hills ARC will celebrate its 50th anniversary by sponsoring the 1985 ARRL Dakota Division Convention on July 5-7, 1985, at Howard Johnson's, Exit 59 off I-90, Rapid City SD. Features include exhibits, a flea market (free tables), forums, and alternate activities for the whole family. Pre-registration and a Saturday-night banquet ticket is $18.00. Pre-registration is $6.50 (pre-registration deadline is June 10). Registration after June 10 is $7.50. Additional banquet tickets are $12.50. Sunday buffet tickets are $6.75 ($3.75 for children 12 and under). Talk-in on .16/.76 and .34/.94. For further information, tune in the SD Evening Net (3870) or call (605)-787-5243 or (605)-343-6791. For pre-registration (make checks payable to Black Hills ARC), write to Gene F. Bauer KX0U, 713 Blaine Avenue, Rapid City SD 57701. Indicate if you desire information on motels or campgrounds.

ATLANTA GA
JUL 6-7

The Atlanta Radio Club, Inc., will sponsor the Atlanta Hamfestival/ARRL Convention in the Georgia State World Congress Center on July 6 and 7, 1985. Everything will be indoors this year, with much improved facilities and access. For further information, contact Bill Schmidt KF4CQ, Secretary and Hamfestival Chairman, 219 Devonwood Drive, Atlanta GA 30328.

TOM SAWYER DAYS
JUL 6-7

The Hannibal Amateur Radio Club, Inc., will operate a special-event station from the National Tom Sawyer Days celebration, on Saturday and Sunday, July 6 and 7, 1985, from 1500-2100 UTC both days. Frequencies will be: 7.245, 14.290, 21.400, and 28.770 phone and 7.125 and 21.125 CW. To receive a certificate, send a large (8 × 10) SASE and your personal QSL card confirming the contact to Hannibal Amateur Radio Club, Inc., W0KEM, 2108 Orchard Avenue, Hannibal MO 63401. For further information, please contact Bob Blackler, 210 N. 6th, Hannibal MO 63401; (314)-221-3723.

KINGSTON PA
JUL 7

The Murgas ARC (K3YTL) will sponsor the annual Wilkes-Barre Hamfest on Sunday, July 7, 1985, rain or shine, beginning at 8:00 am, at the 109th F. A. Armory, Market Street, Kingston PA (across the river from Wilkes-Barre). Admission is $3.00 and women and children under 16 are free. Tailgating spaces are $2.00 each. Tables and commercial power will be available. Setup begins at 6:00 am. Talk-in on 146.01/.61 and .52 simplex. For further information, contact the Hamfest Committee, PO Box 1094, Wilkes-Barre PA 18703; (717)-388-6863.

NATIONAL CHERRY FESTIVAL
JUL 7-13

The Cherryland ARC will operate special-event station KA8QVH to commemorate the National Cherry Festival in Traverse City MI. Daily operation is scheduled from 0100 UTC July 7, 1985, through 0200 UTC July 13, 1985, and will be in the center portion of the 10- through 80-meter General phone and CW bands, and the Novice bands. Send a large SASE with your QSL addressed to Ed Irwin KA8QVH, 346 Peninsula Trail, Traverse City MI 49684, for an attractive National Cherry Festival certificate.

DOUGLAS WY
JUL 12-14

The Great Plains Repeater Association and the High Plains Amateur Radio Club will jointly sponsor the 1985 Wyoming Hamfest, to be held at the Wyoming State Fairgrounds in Douglas, Wyoming, on July 12-14, 1985. Items of interest include distributor displays, indoor flea market (tables available), license exams, seminars, auction, banquet, breakfast, and much more! There will be ample RV parking with or without full hookups (plenty of motels). For full information or advanced registration, please send an SASE to Doug Des-Enfants WA7WXQ, North Star Route, Torrington WY 82240.

DUTCHESS COUNTY NY
JUL 13

The Mount Beacon Hamfest will be held on July 13, 1985, from 8:00 am to 3:00 pm, at the Arlington Senior High School, Poughkeepsie/Lagrange, Dutchess County NY. Admission is $2.00 and XYLs and kids are free. Tailgating spaces are $3.00 and tables are $4.00 (both include one free admission). The auction will take place at 2:00 pm. Free parking and food will be available. Talk-in on 146.37/.97 and 146.52. For more information, contact Julius Jones W2IHY, RR2, Vanessa Lane, Staatsburg NY 12580; (914)-889-4933, or Steve Quigley KD2AK, Straub Drive, Pleasant Valley NY 12569; (914)-635-8539.

OAK CREEK WI
JUL 13

The South Milwaukee ARC will hold its annual swapfest on Saturday, July 13, 1985, from 7:00 am to 4:00 pm, at American Legion Post #434, 9327 South Shephard Avenue, Oak Creek WI. Admission is $3.00, which includes a "happy time" with free beverages. Parking, a picnic area, hot and cold sandwiches, and free overnight camping will be available. Talk-in on 146.94. For a map and more information, write to the South Milwaukee ARC, PO Box 102, South Milwaukee WI 53172-0102.

EAU CLAIRE WI
JUL 13

The Eau Claire Amateur Radio Club will hold its annual hamfest on Saturday, July 13, 1985, from 8:00 am to 4:00 pm, at the 4-H building in Eau Claire WI. Tickets are $2.00 in advance and $3.00 at door. Free tables and coffee will be available. Talk-in on .31/.91 and .52 simplex. For information or tickets, send an SASE to Gene Lieberg KA9DWH, 2840 Saturn Ave., Eau Claire WI 54703.

SHEBOYGAN WI
JUL 13

The Sheboygan County ARC will sponsor the sixth annual Lakeshore Swapfest and Brat Fry on July 13, 1985, from 10:00 am to 4:00 pm, at the Wilson Town Hall, south of Sheboygan WI. Admission is $2.50 in advance and $3.00 at the door. Children under 12 (with family) are free. Tables are free. Camping is available at Terry Andre State Park. Food will be served. Talk-in on .66/.06 and .52. For more information, contact KR9S, 6400 Hawthorn Road, Sheboygan WI 53081; (414)-457-3366 after 5:00 pm CDT.

MAPLE RIDGE BC
JUL 13-14

The Maple Ridge Amateur Radio Club will sponsor the Maple Ridge Hamfest on July 13 and 14, 1985, at St. Patrick's Center, 22589 121st Ave., Maple Ridge, BC. Admission for hams is $5.00, for non-hams $2.00. Food, swap and shop, commercial

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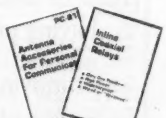

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displays, bunny hunt, ladies' and children's programs will be available (close to shopping and swimming). Camper space (no hookups) will be available. Talk-in on 3.758 MHz, 146.20/.80, and 146.34/.94. For more information or pre-registration (20% off gate admission), contact Maple Ridge ARC, Box 292, Maple Ridge, BC, Canada V2X 7G2.

CHARLESTON SC
JUL 13–14

The Charleston Amateur Radio Society will sponsor the Charleston Hamfest on July 13 and 14, 1985, at the Omar Shrine Temple on East Bay Street, Charleston SC, from 8:30 am to 4:00 pm on Saturday, and 9:00 am to 4:00 pm on Sunday. General admission is $5.00, with children 12 and under going free, which includes the admission to the Hospitality Room (7:30 pm to 11:00 pm Saturday). FCC exams will be given Saturday. There will be a buffet available on both days. Flea-market tables cost $5.00; commercial booths cost $40.00. Talk-in on 146.19/.79. For further information, contact Hamfest Committee, PO Box 70341, Charleston SC 29405; (803)-747-2324 or (803)-554-8058.

SUMMER EXTRAVAGANZA
JUL 13–14

The Parks and Recreation Department of the City of Waynesboro VA and the Valley Amateur Radio Association will operate special-event station KI4BR in Ridgeview Park, in celebration of Summer Extravaganza. Hours will be from 1700 UTC on Saturday and Sunday, July 13 and 14, 1985. A First Edition Certificate will acknowledge QSO and receipt of QSL. Send an SASE to KI4BR, PO Box 565, Waynesboro VA 22980 for further information.

MARION COUNTY IN
JUL 13–14

The Indianapolis Hamfest will be held on July 13 and 14, 1985, at the Marion County Fairgrounds, at the intersection of Interstates 74 and 465, Marion County IN. The $5.00 admission charge entitles you to free parking. Flea-market setup on Saturday is at 8:00 am. Commercial vendor setup on Saturday is at 10:00 am. The hamfest runs to 5:00 pm on Saturday. On Sunday, gates open at 6:00 am and the commercial building opens at 8:00 am. There will be free camper facilities and hookups available on the grounds. There are motels close by. There will be technical forums, the ARRL State Convention, and a banquet. For more information, contact the Indianapolis Hamfest, PO Box 11776, Indianapolis IN 46201.

BATTLE CREEK MI
JUL 13–21

The Southern Michigan Amateur Radio Society will operate W8DF/8 during the Seventh World Hot-Air Balloon Championship, July 13–21, 1985, in Battle Creek, Michigan, at W. K. Kellogg Regional Airport. Operation will be on phone in the center portions of General-class 80–10-meter bands, and CW in the Novice bands. For a special QSL, send an SASE to PO Box 934, Battle Creek MI 49016.

DOWNERS GROVE IL
JUL 14

The DuPage Amateur Radio Club will sponsor a hamfest/computerfest on Sunday, July 14, 1985, at American Legion Post 80, Downers Grove IL. Admission is $3.00. There will be a large outdoor flea market and swappers row. Indoor commercial space will be available. Refreshments and free parking will be available. Talk-in on 146.52 simplex. For more information, send an SASE to W9DUP, PO Box 71, Clarendon Hills IL 60514, or call (312)-971-3294 between 8:00 am and 9:00 pm.

LAPORTE IN
JUL 14

The LaPorte and Michigan City ARCs will sponsor their summer hamfest on Sunday, July 14, 1985, from 8:00 am to 2:00 pm, at the LaPorte County Fairgrounds, on State Road 2, west of Laporte IN. Admission is $3.00. Indoor tables are available by reservation for $.40/ft. Food and parking will be available. For table reservations or for more information, write to PO Box 30, LaPorte IN 46350.

LOUISVILLE OH
JUL 14

The Tusco ARC (W8ZX) and the Canton ARC (W8AL) will sponsor the 11th annual Hall of Fame Hamfest on July 14, 1985, at the Nimishillen Grange, 6461, Easton Street, Louisville OH (just east of Canton on US Route 62). Registration is $2.50 in advance and $3.00 at the gate. Tables are for rent on reserved basis only. Parking is $2.00 per vehicle. The deadline for table reservations is July 1st. Features include good food, a large flea market, dealers, forums, and more. Talk-in on 146.52/.52 and 147.71/.12 (W8ZX). For more information or reservations, contact Butch Lebold WA8SHP, 10877 Hazelview Ave., Alliance OH 44601; (216)-821-8794.

LANCASTER OH
JUL 14

The Lancaster and Fairfield County Amateur Radio Club will hold its annual hamfest on Sunday, July 14, 1985, from 8:00 am to 4:00 pm, at the Fairfield County Fairgrounds, Lancaster OH. Admission is $3.00 in advance and $4.00 at the door. Tables are $4.00 in advance and $5.00 at the door. Space for your table is $3.00 in advance and $4.00 at the door. Refreshments and parking will be available. Talk-in on 147.03/.63 and 146.52 simplex. For more information, write to the Lancaster ARC, PO Box 3, Lancaster OH 43130.

BOWLING GREEN OH
JUL 14

The 21st annual Wood County Ham-A-Rama will be held on Sunday, July 14, 1985, beginning at 8:00 am, at the Wood County Fairgrounds, Bowling Green OH. Admission and parking are free. Advance table rentals are $5.00 to dealers only. The trunk sale will be on a paved lot. Food will be available. Setup is available on Saturday (July 13) until 8:00 pm. Talk-in on 147.18 and .52. For more information or dealer rentals, send an SASE to the Wood County ARC, c/o Craig Henderson N8DJB, 7368 Scotch Ridge Road, Pemberville OH 43450.

BALLOON RACES
JUL 19–20

The Indian Hills Community College Amateur Radio Club will sponsor a special-event station during the 1985 Ottumwa Hot-Air Balloon Races on Friday, July 19, 1985, and Saturday, July 20, 1985. The club will operate under club callsign WA@IUQ on SSB only on the following frequencies: 3960, 7260, and 14260 kHz (QRM permitting). Operation will commence at 2200 UTC and end at 0400 UTC each day. A commemorative QSL card will be issued to all amateurs who contact WA@IUQ and provide a SASE with their QSL card. QSL to WA@IUQ *Callbook* address.

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PETOSKEY MI
JUL 20

The Straits Area ARC will hold its twelfth annual Swap 'n' Shop on July 20, 1985, from 9:00 am to 2:00 pm, at the Emmet County Fairgrounds, Petoskey MI. Admission is $2.50 and tables are $3.00. Refreshments will be available. There will be free parking Friday night for self-contained RVs. Petoskey State Park is also nearby. Talk-in on .07/.67 and .52. For more information, send an SASE to Joe Werden WD8MJB, Chairperson, PO Box 444, Conway MI, or call (616)-347-8693.

SUSSEX COUNTY NJ
JUL 20

The Sussex County ARC will sponsor SPARC 85 on July 20, 1985, beginning at 8:00 am, at the Sussex County Fairgrounds, Plains Road, off of Route 206. Admission is $2.00. Indoor tables are $7.00 each and tailgate spaces are $5.00. Free parking and refreshments will be available. Talk-in on 147.90/.30 and 146.52. For further information, contact Donald R. Stickle K2OX, Weldon Road, RD #4, Lake Hopatcong NJ 07849; (201)-663-0677.

WELLINGTON OH
JUL 20

The Northern Ohio Amateur Radio Society will sponsor a NOARSfest on July 20, 1985, at the Lorain County Fairgrounds, Wellington, Ohio. Tickets are $2.50 in advance and $3.00 at the door. There will be ample indoor commercial space, although reservations are required. There will be a huge outdoor flea-market area. There is a $3.00 charge per car space. Overnight parking is available for RVs and campers (no hookups). Talk-in on 146.10/.70. For FCC exam information, contact Dave AI8M, 331 Courtland, Elyria OH 44035; (216)-324-4574. For reservations, information, or tickets, write to NOARSfest, PO Box 354, Lorain OH 44052; (216)-282-4256.

TOPSFIELD MA
JUL 20-21

The first annual Heavy Hitters Hamfest will be held on Saturday and Sunday, July 20-21, 1985, from 9:00 am to 4:00 pm (both days), at the Topsfield Fairgrounds, US Route 1 (8 miles north of Route 128), Topsfield MA. Admission is $3.00 in advance and $4.00 at the door. Non-ham spouses and children will be admitted free. There will be a giant flea market (with ample indoor space in case of rain). Flea-market setup begins at 6:00 am on Saturday. Features include commercial exhibitors, forums on the ARRL, packet radio, AMSAT, ATV, and ARES/RACES, CW and QSL contests, a hidden transmitter hunt, ATV and packet demonstrations, a traffic-handlers' rap session, a musical coffeehouse (BYO instruments), and refreshments. Alternate activities include sports, a local guided hike, Trivial Pursuit, and a first-aid lesson. There will be free Saturday-night camping for tents and self-contained RVs. Talk-in on 146.64 and 147.285. License exams (no Novice exams) will be held at a nearby school. Send Form 610 and a check for $4.00 payable to ARRL/VEC by June 21 to Topsfield Exams, c/o PO Box 71, Hanover MA 02339. For advance tickets, send an SASE to Heavy Hitters Hamfest, PO Box 411, Waltham MA 02254. For further information, contact Russ Corkum WA1TTV, 21 Thorndike Street, Arlington MA 02174.

DES MOINES IA
JUL 20-21

The Des Moines Radio Amateur Association will hold an Electronic Fair in Des Moines IA on July 20 and 21, 1985, at the Airport Hilton Inn, to showcase the latest in satellite television, computers, amateur radio, and electronics. The fair combines the Iowa American Radio Relay League Convention with the Des Moines Hamfest. Technical seminars will be held both days featuring excellent programs for computer and satellite enthusiasts, amateur-radio operators, and spouses. Admission fee is $2.00; $3.00 for flea-market parking. There will be a banquet the evening of July 20, 1985, at a cost of $15.00 per person. Additional details are available from the Des Moines Radio Amateur Association, PO Box 88, Des Moines IA 50301.

WHEELING WV
JUL 21

The Triple States Radio Amateur Club will hold its 7th annual Wheeling WV Hamfest and Computer Fair on Sunday, July 21, 1985, from 9:00 am to 4:00 pm, at Wheeling Park, Wheeling WV. Admission is $3.00. Children under 12 are free. Dealers are welcome. Everything is under one roof, and tables will be available. There will be 5 acres of flea market, free parking, and refreshments. Talk-in on 146.31/.91 or 147.75/.15. For further information or a map, contact Jay Paulovicks KD8GL, RD 3 Box 238, Wheeling WV 26003; (304)-232-6796, or TSRAC, Box 240, RD 1, Adena OH 43901; (614)-546-3930.

OSHKOSH WI
JUL 26-AUG 2

The Oshkosh Amateur Radio Club, in conjunction with the SOLAR Association (a repeater co-op), will host EAA hams for the 1985 convention from July 26, 1985, through August 2, 1985, at Wittman Field, in Oshkosh. The EAA Ham Shack Hospitality Site, located at the north end of the commercial exhibit area, will be available for you to rest your feet, charge your batteries, or leave messages. Look for the red and white ARRL flag. On Saturday, July 27, 1985, at 3:00 pm, there will be a gathering for all EAA hams hosted by the Oshkosh Amateur Radio Club. Bratwurst, burgers, and refreshments will be available free of charge. Bring the whole family. If you have never had a *real Wisconsin* bratwurst, you are in for a real treat! Information throughout the convention will be available via the 147.945 repeater, or by stopping at the EAA Ham Shack Hospitality Site in person. Ground communications will also be run on 146.400 simplex. Both frequencies will be monitored for the entire week. For further information, contact Forest Schafer WD9IWL, 417 Willow Street, Omro WI 54963.

MANISTIQUE MI
JUL 27-28

The 1985 Upper Peninsula Hamfest will be held on July 27-28, 1985, from 6:00 am to 5:00 pm on Saturday, and from 8:00 am to 2:00 pm on Sunday, at St. Francis de Sales School, Manistique MI. There will be a fish fry, early setup, and eyeball QSO for those who arrive on Friday evening. A banquet will be held on Saturday at 6:30 pm. Registration is $3.50. Table space is $3.00 per 4-foot table. Free babysitting will be available. For more information, contact Debbie Barton WD8IBT, 509 Range Street, Manistique MI 49854; (906)-341-5694 after 3:00 pm.

OLIVER BC
JUL 27-28

The Okanagan Valley of British Columbia will sponsor the Okanagan International Hamfest on July 27th and 28th, 1985, beginning at 9:00 am on Saturday, July 27th, at the Oliver Centennial Park, Oliver, British Columbia. Bring your hobbies/crafts for display or sale. Please note that the potluck supper on Saturday has been changed to 6:00 pm. Talk-in on 146.34/.94 and .76/.76. For further information, contact Lota Harvey VE7DKL, 584 Heather Road, Penticton, BC, Canada V2A 1W8; (604)-492-5768.

SPACE DAY
JUL 27-28

The Cascades Amateur Radio Society will sponsor their third annual Space Day from the Michigan Space Center. Special-event stations will be on the air from 0000 UTC July 27, 1985, through 1900 UTC July 28, 1985, 10 kHz into the General portions of all bands. For a certificate, send QSL and $1.00 for postage and materials to CARS, PO Box 512, Jackson MI 49204.

MOSCOW BLOWOUT
JUL 27-28

The Wichita Amateur Radio Club is sponsoring a Moscow Blowout at Moscow KS on July 27 and 28, 1985. The callsign will be W0SOE. The frequencies will be 5 to 10 kHz from the bottom edge of the General phone bands. QSL will be via W0SOE. There will be a mini-DXpedition to give everyone a chance to work Moscow.

ASHEVILLE NC
JUL 27-28

The Western Carolina Amateur Radio Society will hold its annual hamfest on Saturday, July 27, 1985, and Sunday, July 28, 1985, at the Buncombe County Firemen's Training Center in Asheville NC. Admission is $4.00 at the gate and $3.50 in advance. There will be camping (no hookups), forums, bingo, free parking, and VEC exams. For outside flea-market sites, bring your own table. Talk-in on .16/.76 and .31/.91. For advance tickets, contact Marvin Soloman KI4EA, 14 Carjen Avenue, Asheville NC 28804. All other inquiries should go to Earl Elliott KI4UO, 17 Emory Road, Asheville NC 28806.

WEST FRIENDSHIP MD
JUL 28

The Baltimore Radio Amateur Television Society (BRATS) will sponsor the Maryland Hamfest and Computerfest on Sunday, July 28, 1985, at the Howard County Fairgrounds, Route 144 at Route 32, adjacent to I-70, West Friendship MD. The facilities are accessible to the handicapped. Admission is $4.00. Tables along a wall with access to ac power are $20.00 each, or 4 for $75.00. Tables in the center of the floor are $10.00 each, with special rates for booths of 12 or 16 tables. Tailgating is $3.00 per space. Dealer setup will begin at 2:00 pm on Saturday, July 27 (overnight security will be provided). Free VE examinations will be given and no advanced registration is required. Refreshments will be available. Talk-in on 146.16/.76, 147.63/.03, and 146.52. For further information or for table reservations, contact Mayer Zimmerman W3GXK, BRATS, PO Box 5915, Baltimore MD 21208.

DENVER CO
JUL 30-AUG 1

The Amateur Radio Motorcycle Club Rocky Mountain Roundup III will be held July 30 through August 1, 1985, somewhere west of Denver CO. The exact location will be named later. Riding radio operators check the ARMC Net on Thursday nights, 0300 UTC, 7237.5 kHz. Send a business-size SASE to Gary McDuffie AG0N, Rt. 1, Box 464, Bayard NE 69334, and ask for net information.

JACKSONVILLE FL
AUG 3-4

The twelfth annual Greater Jacksonville Hamfest will be held on August 3-4, 1985, from 8:00 am to 5:00 pm on Saturday, and from 9:00 am to 3:00 pm on Sunday, at the Jacksonville Civic Auditorium, on the waterfront in downtown Jacksonville. Admission is $4.00 and children under 16 will be admitted free. Swap tables are $9.00 for one day and $15.00 for both days. Forums, meetings, technical presentations, and an exhibitors' area and indoor swap area will be featured. The facilities are completely air conditioned. For more information, ta-

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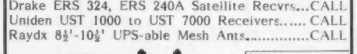

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ble reservations, or hotel information, send an SASE to the Jacksonville Hamfest Association, PO Box 23134, Jacksonville FL 32241.

TALK SO THEY MAY WALK
AUG 3–4

The Kansas City MO Ararat Shrine Radio Club (WA0NQA) will host its second annual talk-in on August 3–4, 1985, for the benefit of the Crippled Children's Hospitals. We will look for you on the air from 10:00 am to 10:00 pm CST. We will be on the lower 10 kHz of 80, 20, 40, and 15 meters, as well as the 40-meter Novice band. We will offer a two-color certificate with your call and name. Send a large SASE and $1.00 to QSL Manager, Mr. J. V. Foust KA0GBK, 5240 N. Palmer, Kansas City MO 64119.

GLENN MI
AUG 4

The Black River Amateur Radio Club will sponsor its annual VHF Picnic and Swap and Shop on Sunday, August 4, 1985, from 10:00 am to 3:00 pm, at the West Side Allegan County Park near Glenn MI (10 miles north of South Haven via I-196, Exit 30). Admission will be $2.00. There will be free table and trunk sales. There will be picnic tables, a playground, a Lake Michigan beach, and ample parking. There is no food vendor in the park. For more information, contact Ed Alderman KI8Z, 56500 48th Ave., Lawrence MI 49064; (616)-674-3567.

WORLD POLICE/FIRE GAMES
AUG 4–7

The San Jose State University ARC will operate W6YL to commemorate the 1985 World Police/Fire Games. Operation will be from: 1900 UTC August 4 to 0700 UTC August 5; 1900 UTC August 5 to 0700 UTC August 6; 1900 UTC August 6, to 0700 UTC August 7. There will also be some operation August 7 through 11. Frequencies will be 3.870, 7.240, 14.270, and 147.555 for phone; 7.125 and 14.040 for CW. For a special certificate, send a large SASE to SJSU ARC, c/o Student Programs and Services, Box 2, San Jose State University, San Jose CA 95192.

GEORGETOWN KY
AUG 11

The Bluegrass Amateur Radio Society will sponsor the Central Kentucky ARRL Hamfest on Sunday, August 11, 1985, from 8:00 am to 5:00 pm, at the Scott County High School, Longlick Road and US Route 25, Georgetown KY. Tickets are $3.50 in advance and $4.00 at the gate. There is no charge for outside flea-market space. Features will include technical forums, license exams, awards, and exhibits—all in air-conditioned facilities. Talk-in on .76/.16. For more information or tickets, send an SASE to Scott Hackney KI4LE, 629 Craig Lane, Georgetown KY 40324.

WILLOW SPRINGS IL
AUG 11

The Hamfesters Radio Club, Inc., will sponsor their 51st annual hamfest on Sunday, August 11, 1985, at Santa Fe Park, 91st and Wolf Road, Willow Springs IL, southwest of Chicago. There will be an exhibitor pavilion and the famous swappers row. Tickets at the gate will cost $4.00; in advance $3.00. Talk-in on 146.52. For tickets, mail check or money order to Hamfesters, PO Box 42792, Chicago IL 60642.

ST. CLOUD MN
AUG 11

The St. Cloud Amateur Radio Club will hold a hamfest on August 11, 1985, at the Sauk Rapids Municipal Park, on the north edge of Sauk Rapids off MN Highway 15 (Benton Drive). Displays, demonstrations, and trades will be featured. Tickets will cost $3.00. There will be a snack counter. Talk-in on .34/.94 primary, .615/.015 secondary. For further information contact SCARC, Box 141, St. Cloud MN 56302.

DALTON MA
AUG 11

The Northern Berkshire Amateur Radio Club will sponsor a hamfest on Sunday, August 11, 1985, beginning at dawn, at the Dalton American Legion, Route 9, Dalton MA. Admission is $1.00, with XYLs, YLs, and children admitted free. A few tables will be available at no charge on a first-come, first-served basis. Food will be available. Free overnight camping will be permitted on Saturday night (August 10) beginning at 6:00 pm. Talk-in on 146.91.

GREEN BAY WI
AUG 17

The Green Bay Mike and Key Club's Summer Swapfest will be held on Saturday, August 17, 1985, at the Ashwaubenon Community Center, Anderson Drive, located across from Baypark Square Mall (take the Oneida Street Exit off either Hwy. 172 or US Hwy. 41). There will be free admission and parking. Doors open at 8:00 am. 8-foot tables are available by reservation at a charge of $5.00, with a 4-table limit. For further information, contact Bill Johnson N9CNO, 2177 Orrie Lane, Green Bay WI 54304; (414)-494-8948.

WASHINGTON DC
AUG 22–24

The Personal Computer and Standard Computer Interfacing for Scientific Instrument Automation Workshop, sponsored by Virginia Tech, will be held August 22–24, 1985, in Washington DC. The cost is $450 for the three-day session. This is a hands-on workshop, with each participant wiring and testing interfaces. The course will be directed by Mr. David E. Larsen and Dr. Paul E. Field. For more information, contact Dr. Linda Leffel, C.E.C., Virginia Tech, Blacksburg VA 24061; (703)-961-4848.

ITHACA NY
AUG 24

The Tompkins County Amateur Radio Club will sponsor the Finger Lakes Hamfest on August 24, 1985, 12 miles north of Ithaca NY on Route 96. There will be a flea market, dealers, programs, and free overnight camping. Talk-in on .37/.97. For more information, contact David Flinn W2CFP, 866 Ridge Road, Lansing NY 14882; (607)-533-4297.

MARYSVILLE OH
AUG 25

The Union County ARC will sponsor its 9th annual hamfest on August 25, 1985, from 6:00 am to 4:00 pm, rain or shine, at the fairgrounds in Marysville OH. Admission is $3.00 at the gate, $2.00 in advance. Children and XYLs are admitted free. Flea-market space is $1.00 per 10-foot space. There will be overnight camping permitted on Saturday night. Food will be available. For further information, contact Gene Kirby W8BJN, 13613 US 36, Marysville OH 43040; (513)-644-0468.

WILLOW SPRINGS IL
SEP 8

The Bolingbrook Amateur Radio Society will hold BARS Hamfest 85 on Sunday, September 8, 1985, at Santa Fe Park, 91st Street and Wolf Road, Willow Springs IL. Admission is $2.00 in advance and $3.00 at the gate. Overnight parking will be available. Food will be available. Talk-in on 147.33/.93 and 146.52. For more information, contact Ed Weinstein WD9AYR, 7511 Walnut Avenue, Woodridge IL 60517; (312)-985-0527.

GREAT SALT PLAINS LAKE
SEP 8

The third annual Great Salt Plains Ham Social (serving the Oklahoma-Kansas state line area) will be held on September 8, 1985, at the community building on the south side of Great Salt Plains Lake. Free swap tables and refreshments will be available. Talk-in on 147.90/.30. For more information, contact Steven Walz WA5UTO, PO Box 222, Cherokee OK 73728; (405)-596-3487.

WIA 75TH ANNIVERSARY

The Wireless Institute of Australia, the world's first radio society, will celebrate its 75th anniversary during 1985. The WIA 75 Award will be available during the period from March 1, 1985, to December 31, 1985. To qualify, amateurs (and SWLs) need to contact (log) 75 members of the WIA. A contact will be valid only if the WIA member's individual membership number is logged. No more than 30 WIA members may be logged in any one callsign area. Send a log extract of the 75 members contacted and $2.00 (Australian) to WIA 75 Award Manager, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy 3065, Victoria, Australia.

HAM HELP

I am in need of a schematic and information about the type of needle needed for an old General TV and Radio model 337 phonograph.

Bill Fletcher AF9B
3302 Leopold Way #111
Madison WI 53713

I am in need of the manual and/or schematic for the Mullard C11 transmitter and matching receiver (British Military), as well as the manual for the Hallicrafters Sky Champion shortwave receiver. I will gladly pay for any costs involved.

Carl Nielsen VE7EAO
120 Gull Cr.
Prince Rupert BC
V8J 4G5 Canada

I would like to correspond with anyone who has used a Tano Corp. Dragon computer for any purpose.

M. McDaniel W6FGE
940 Temple St.
San Diego CA 92106

I am looking for information or help from anyone who has converted an SSB CB (Midland 13-893) to 40 meters. Any assistance will be appreciated.

James Crawford KD5YD
PO Box 643
Lovington NM 88260

I need a manual for the ORD DK-1 keyer. It was made by ORD, Inc., of Fort Worth, Texas, around 1970. I will gladly pay for copying and postage charges.

Bill Unger VE3EFC
RR No. 11
Thunder Bay ON
P7B 5E2 Canada

Data and manuals needed for an Okidata CP-110 dot-matrix printer. I will pay for the cost of copying and postage. I plan to use it with a TI-99/4A Kantronics Interface pack.

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CLIPPERTON ISLAND

Clipperton Island. The very name sends chills along the spines of long-time DXers. Clipperton is synonymous with inaccessibility, pirates, danger, and frustration. Once on the top of most-wanted lists, Clipperton has been on the air a total of less than two weeks in the last 25 years. Reports of groups planning to go to Clipperton are second only to Albanian operations as prime discussion in the DX rumor mill. Finally, this spring, more than a dozen amateurs did the impossible and put Clipperton Island on the air as FO0XX, but not without a few reminders that Clipperton is, after all, one of amateur radio's toughest nuts to crack.

Clipperton Island lies in the Pacific due west of San Jose, Costa Rica, and due south of Albuquerque, New Mexico, about 700 miles off the Mexican coast. Its 2 square miles of flat coral and sand surround a nearly-stagnant lagoon, with only one large rock and a few trees sticking up more than a few feet above the tide line. It has no harbor, and landing through its heavy surf is always risky. Even the island's name reflects its sinister nature; it stems from John Clipperton, an eighteenth century pirate who used the island as a base to raid coastal shipping.

Clipperton is now controlled by France and considered part of French Polynesia, but such was not always the case. Since its discovery in 1527, Clipperton has been claimed by Mexico, France, the United States, and Great Britain. Early this century, the king of Italy, Victor Emannuel, was asked to decide whose claim was valid. Apparently not one for snap decisions, the king took more than 20 years to make up his mind in favor of France.

Clipperton has remained uninhabited for most of its history, with a few exceptions. Besides the early pirates, Mexico established a small colony on the island to bolster its claim over the island. Most of the party died when supply ships stopped arriving from the mainland. The US maintained a small base on the island during WWII, but only birds and crabs have called Clipperton "home" since the war.

The First Clipperton DXpedition

Prior to this year's successful DXpedition, Clipperton had only been on the amateur bands three times. The first amateur operation on Clipperton was in the spring of 1954, when a group of Iowa DXers, led by Bob Dennison (now W0DX and VP2VI), hopped in a car and drove to Acapulco, Mexico. The group hired an 83-foot diesel ship and set out for Clipperton. 500 miles out to sea, the ship's navigator tripped over an unstowed transmitter, fell, and broke the ship's only sextant. Since Clipperton is hard enough to find with proper navigational gear, Bob Dennison enlisted the FCC to help pinpoint the ship's location by direction finding techniques. With this help, the hams guided the ship to the right vicinity, but they were unable to spot Clipperton Rock. After sailing around for a few days without locating the island, the ship's captain turned around and steamed back to Acapulco. Clipperton had struck the first blow in what was to be a prolonged battle with DXpeditioners.

Undaunted, Bob and the other Iowa hams tried again the next week, this time with a sailing craft, the *Barca*. The navigation worked this time, and five days after leaving Acapulco, the crew spotted Clipperton Rock just before nightfall. The next morning, however, there was no sign of the island; strong winds and ocean currents had swept the ship well past the island. Unable to fight the combined forces of both wind and current, the *Barca* drifted further away from the elusive Clipperton and finally was forced to call for help.

A ship from the Mexican Navy responded to the distress calls and soon joined the *Barca* around Clipperton. This ship towed the *Barca* upwind to Clipperton and stood by offshore as the amateurs worked their way through the treacherous surf to their landing site. The DXers' troubles were not yet over, however. Their boat overturned in the surf, flooding their generator, which retaliated for its dunking by generating vast amounts of QRN as well as ac. Finally, the overworked generator ran out of oil and stopped permanently.

Meanwhile, a second Mexican naval vessel hove to off Clipperton, bearing supplies for the hard-luck DXpeditioners. Among the supplies was a second generator, but the naval ships had been ordered back to Mexico and wanted the hams to leave the island. Bob Dennison managed to stall for a few more days and made 1108 QSOs as FO8AJ before accepting a tow back toward the mainland. That first Clipperton DXpedition took 22 days and soured the French authorities on the whole idea of amateurs visiting the remote island. Besides a few contacts made during the 1957-8 International Geophysical Year, nothing more was heard from Clipperton on the amateur bands for 20 years.

Fig. 1. Isolated Clipperton Island sits 700 miles off the Mexican coast.

By the late 1970s, Clipperton was at the top of everyone's most-wanted list. A well-organized group of Swiss, French, and American hams finally assembled the funding, operators, and equipment needed to meet the stiff requirements of the French government, requirements established to prevent a repeat of the FO8AJ troubles. The 1978 DXpedition made about 30,000 contacts, to the great satisfaction of everyone except the Europeans, who never had good propagation to Clipperton.

The 1985 DXpedition

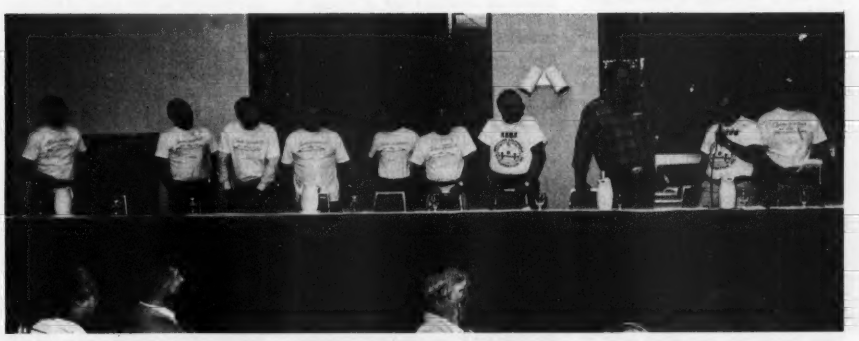
Thanks in part to the success of the 1978 DXpedition, the French government has been more receptive to the idea since that time, and impatient DXers didn't have to wait another 20 years for Clipperton. Only a few years after the '78 trip, amateurs were preparing for the next onslaught on Clipperton. Unfortunately, this latest DXpedition started almost as badly as the 1954 one. The Clipperton DXpedition was originally scheduled for early 1984, and the operators assembled in Mexico in the spring of that year to await their chartered boat. The boat never arrived. After more than a week of sitting around the hotel, the operators reluctantly canceled their plans and returned home. Shades of 1954. They didn't give up, however, and continued to search for a suitable vessel. Once again proving the value of perseverance, the group finally located and chartered the *Royal Polaris*, a fishing craft which had made several previous trips to the area.

Sixteen amateurs from seven countries formed the operating team for the 1985 trip, which set out from Mexico in early April. On the way to Clipperton, the group suffered another disappointment. They had hoped to spend a day on the air from Revilla Gigedo XF4 before continuing on to Clipperton and had obtained a suitable license. Unfortunately, a group of Mexican DXers planned to operate from XF4 at about the same time, so the Clipperton gang's operating permission was for San Benedicto Island only, not the more accessible Socorro Island, from which the XE group would operate. As the *Royal Polaris* steamed around San Benedicto, the DXpeditioners could clearly see that the island had no possible landing, had no way to get operators, generator, and gear to the top of the 200+-foot surrounding cliffs. Maybe next itme, said the operators, as they continued to motor toward Clipperton.

A few days later, on schedule, the *Royal Polaris* dropped anchor off Clipperton. And then the frustration really began. The operators were within sight of their long-sought objective, but the surf pounding on all sides of the island prevented landing. For three days the *Royal Polaris* circled the island, looking for a possible landing spot. The hams considered swimming ashore, but the sharks in the ocean looked even hungrier than the DX sharks on 20 meters. One early attempt to land almost ended in disaster. As their small landing skiff approached the encircling reef, a large wave flipped the craft, dumping the DXers onto the sharp coral. The hams righted their boat and returned to the *Royal Polaris* with only minor cuts, but the incident underscored the dangers of Clipperton's surf.

Finally their luck turned, and the seas calmed just enough to get gear, provisions, and operators ashore. The surf was still too strong to land near the WWII base, from which the 1978 crew operated. This year's Clipperton DXpeditioners pitched their tents on a narrow strip of sand near some coconut trees and hard by an abondoned ammo dump. As it turned out, the only explosions were on the ham bands, whenever FO0XX appeared.

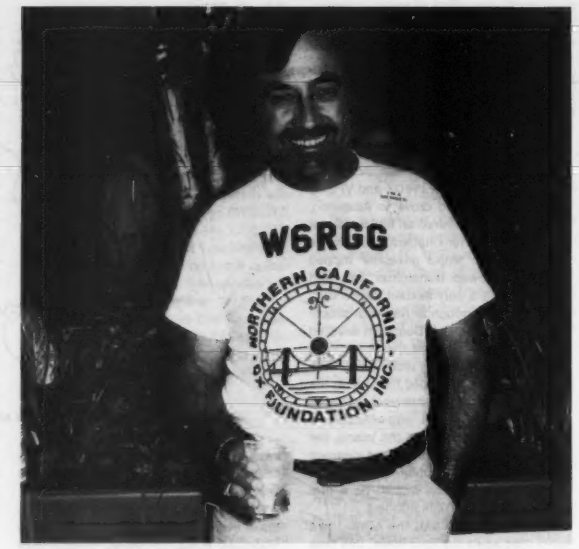
Once ashore on Clipperton, the DXpedition proceeded as planned, with only an occasional visit from Murphy. Their Cushcraft AV5 verticals and A3 tribander survived the high winds, heavy rains, and salt spray that plague the island. For generators, the group chose Chinese diesel models, which used the same fuel as the *Royal Polaris*. These all-important items performed well throughout the DXpedition. Aside from the minor glitches expected in so complicated an endeavor (plugging a 110-V amp into a 220-V generator, using a 15-meter W3LPL narrowband filter on 40 meters, etc.), the amateur-radio



Some of the Clipperton DXpedition team, still sporting Clipperton tans only days after their return.

side of the DXpedition proceeded smoothly, and the operators kept stations on every open band. And as one well-tanned operator remarked upon his return, "The pileups were worth the trip!"

The island was less attractive between operating shifts. Although the group at first ate well, including steak and fresh fish, the trip was no picnic. 10–40-mph winds whipped tent flaps, food, and anything not tied down. Temperatures in the 80s and 90s and very high humidity combined with blinding sun to make daytimes unpleasant. Grade 15 sunscreens were the order of the day. At night, heavy rains flooded the tents (at least they had plenty of fresh water!). The famous Clipperton crabs invaded their camp in force, eating just about anything that didn't move, including toes. But the real problem was the birds. Lots of birds. Hundreds and thousands of birds, each apparently aiming at the DXpeditioners and their tents. Judging by the condition of the tents after only a few days, it is no wonder that Clipperton was once a major source of guano. The 16 DXpeditioners, not in the mood to be mined for their guano deposits, took a dim view of their feathered friends. Such is the lot of the serious DXpeditioner.



Bob Vallio W6RGG survived his FO@XX experience, but he has no plans to return.

A Harrowing Moment

The group was prepared for unwanted visitors, as they remembered the pirates that other DXpeditioners encountered on Palmyra Island, not to mention Clipperton's namesake. For a moment it looked as though these preparations were well-founded, when a small helicopter circled overhead and started dropping small bombs. Everything turned out for the best, however, when the hams discovered the helicopter's passenger was a fellow amateur from a Mexican fishing vessel in the area. The bombs were used to scare birds away from beneath the helicopter, not to frighten the DXers. Amateur radio's spirit of international cooperation prevailed, and soon the Mexican ham offered to replenish the DXpeditioners' fresh vegetable supply and won everyone's gratitude with a case of *cold* beer!

All too soon the time came to pack up and leave Clipperton to the birds and crabs. And once again Clipperton proved to be formidable. As the DXpeditioners started to strike their camp and prepare for the difficult passage back to the *Royal Polaris*, the surf once again rose to unmanageable levels. A day went by, and then another. The crew began to wonder when they would be able to leave Clipperton. The fresh food gone, they were living on freeze-dried foods and what fish they could catch. Finally, on the third day after deciding to leave, the seas calmed sufficiently to try to leave. As the DXpeditioners ferried themselves and their gear out past the reef to the *Royal Polaris*, the surf upended one of the skiffs, dumping hams and rigs into the sea. Fortunately, no one was injured, and the sharks kept their distance. As they left Clipperton, a shaken member of the DXpedition remarked, "If we hadn't gotten off the island when we did, we wouldn't have gotten off at all."

Operating Results

The DXpedition was quite a success, despite the delay of a year and the difficulties getting on and off the island. The crew made almost 31,000 contacts, meeting their goal of more QSOs than any previous DXpedition to the island. Their contacts were split about 2:1 in favor of single sideband, on every band except 40. As expected, 20 meters provided the bulk of the contacts, with more than 11,600 QSOs. Reflecting the decline in sunspots, the crew made almost three times as many contacts on 80 meters as on 10. They even made about 100 contacts through Oscar 10, providing some satellite enthusiasts with a unique opportunity.

The 31,000 contacts included QSOs with hams in 130 DXCC countries, on all continents. The pileups never stopped, but the operators did their best to work as many deserving DXers as possible, as fast as 300 contacts per hour under good conditions. At times, the only way to keep order in the pileup was to work stations by call areas. And the operators noticed an interesting change in the Japanese operators when Clipperton DXpeditioner Kay Saki JG3LZG took the mike. As soon as Kay started talking in Japanese, the normally well-disciplined JAs broke into a chaotic rabble! Nevertheless, most amateurs who needed Clipperton had ample opportunity to log one of amateur radio's rarer QTHs. The only exception was the same group who missed the 1978 trip: the European amateurs. Once again, propagation did not favor Europe, and many Europeans will have to wait a few more years for their FO@X QSL card. If you were among the more fortunate DXers who did work FO@XX, QSL via the Yasme Foundation, PO Box 2025, Castro Valley CA 94546.

These 30,000+ contacts came at a total cost of almost $3/QSO. About a third of the cost was covered by donations of equipment and money, but the DXpeditioners themselves picked up the majority of the costs. Stay-at-home DXers wanting to help defray the costs of the trip and help ensure the success of future DXpeditions to Clipperton and elsewhere can send a contribution to the Northern California DX Foundation, Box 2368, Stamford CA 94305. Or you might consider joining the Clipperton DX Club, for $17: Contact Patrick Bittiger F6EYS, 8 rue du General Ganerval, 67000 Strasbourg, France. Or add a small contribution to the cause to your QSL request.

The 1985 Clipperton DXpedition is now history, with only slides and QSLs to mark the event. For those DXers who missed this chance to confirm FO@X, the wait for the next amateur operation from Clipperton may be quite long, certainly several years. And will any of this year's veterans join the next trip? "No Way." "Never Again." "You've got to be kidding." Apparently one visit to amateur radio's hard-luck island is enough for everyone.

Thanks to July, 1954, *QST*; April 1, 1985, *QRZ DX*, and the Clipperton DXpeditioners for their assistance with this column.

BE MY GUEST

Guest Editorial by Donald Chester K4KYV

AM IS BACK

In tuning across the HF phone bands, many amateurs seem surprised when they learn that there is a substantial amount of AM phone activity on the air. Indeed, amidst all the discussion about stagnation in amateur radio, AM seems to be the one specialty interest which is actually growing at the present time. Those who take the attitude that amateurs who still operate AM are merely diehards who ignore the realities of today's technology have missed the point entirely.

Present-day AM operators may choose to use this mode for a variety of reasons. Undoubtedly, some are old-timers who simply enjoy the nostalgia of pulling their 30-year-old Globe Kings and BC-610s out of the closet and firing them up. Nevertheless, upon listening to AM QSOs in progress, one soon discovers that a large percentage of the AMers are young—some still in high school. Astounding as it may seem, AM operators frequently discuss such topics as building, repairing, and modifying transmitters and receivers and experimenting with circuits; there are even some home-brew rigs on the air! Some of these amateurs are audiophiles whose challenge is to achieve superb voice quality. Others appreciate working at a level of technology wherein the average amateur without a degree in engineering can get the feel of meaningful hands-on experience inside a piece of radio equipment. Some of the AMers simply got bored with mainstream amateur radio and decided to try something different. Others may be found up to their elbows in high-tech, experimenting with such innovative circuitry as pulse-duration modulation and synchronous detection.

Section 97.1 (c) of our rules lists as part of the basis and purpose of amateur radio "...advancing skills in both the communication and technical phases of the art." This means that amateur radio is intended to serve in part as a means by which an individual can provide self-instruction in the radio art. AM technology is one of the basic foundations upon which much of today's high technology is built. The amateur's self-instruction may range anywhere from experimenting with the elementary fundamentals of modulation all the way to spread spectrum, packet radio, ACSB, and other marvels of the 1980s. Now, any college math student will agree that one cannot feel comfortable with differential equations without having first mastered the calculus, and that would be impossible without a strong background in algebra and arithmetic. No wonder there is widespread concern about the present-day amateur's lack of interest in building and experimentation. Is one to be labeled a "diehard" for not expecting a newly licensed General with no prior hands-on experience to immediately dive into digitally-controlled phase-locked loops?

Perhaps the most convincing evidence that AM is alive and well, other than actually hearing the AM signals on the air, can be found by glancing through the ads in a recent issue of any of the popular amateur-radio magazines. You will notice that most of the imported HF transceivers now include the AM mode along with CW, FSK, SSB, and FM. This wasn't true five or ten years ago. Let us be realistic; it would be inconceivable for these large manufacturers serving major markets throughout the world not to use some sort of marketing research to determine consumer demand. Since these companies are very cost competitive with each other in what appears to be a dwindling market, they would not be raising the retail prices of their radios by as much as $100 each in order to include AM transmitting capability if they were not convinced that there is indeed a market demand for amateur-radio products which include the AM mode.

Those who oppose the use of AM on the amateur bands usually argue that the double sideband signal, with twice the nominal bandwidth as SSB, takes up too much spectrum in today's "congested" bands. If the one and only justifiable goal of amateur-radio experimentation is spectrum conservation and generating the narrowest possible signals, then perhaps voice operation should be eliminated entirely. Five to ten CW stations could simultaneously operate in the space occupied by *one* SSB signal. Besides, everyone agrees that CW penetrates the QRM and QRN better than SSB, AM, or FM. Of course, CW is much slower than voice, but that is one of the penalties we must pay for spectrum conservation. With today's technology which includes computers and interfaces, keyboards, code readers, and exotic RTTY systems such as AMTOR, many of the drawbacks formerly associated with "CW" communication can now be overcome by high-tech. The new 10.1-

10.15-MHz band has already set the precedent. Think how many more signals could be crammed into the existing HF amateur bands if they were all CW only!

Seriously, of course, none of our modes should be eliminated. Many of us operate voice because we find it more enjoyable than manipulating a telegraph key or typing out messages on a keyboard, despite the fact that even SSB uses more spectrum. Some of us prefer AM over SSB for precisely the same reason others prefer SSB over CW! Why should the limit to preference vs. spectrum economy be arbitrarily set at the bandwidth of SSB? While a clean SSB signal takes the bandwidth of at least five CW signals, the bandwidth of a clean AM signal only takes twice the bandwidth of an SSB signal.

One of the unique features of the Amateur Radio Service is the wide variety of frequencies and emission modes available for communication and experimentation. In 1981, rejecting a petition (RM-3665) which sought to phase out AM, the FCC stated that "The Commission's aim is to provide the amateur radio operator with diverse modes of communication for experimentation rather than to restrict him/her to certain specific methods of communication."

Today there is serious concern over the stagnation in growth of amateur radio. Unfortunately, a commonly expressed attitude is that "only *my* specialized interest in amateur radio is worth preserving, so I don't care if your favorite activity is eliminated." Such griping is likely to turn off any potential newcomer who might happen to be tuned in to the conversation, in addition to the deliberate interference and jamming, racial and ethnic slurs, foul language, insults and threats, and arguments over frequencies, etc., which have become so common on the voice bands today. Interestingly, very little of this behavior is heard coming from the AM stations. There is room in our bands for all the legal modes of emission and diverse operating activities presently enjoyed by amateurs. We should all be pleased that the AMers are on the air and displaying a little genuine interest in the technical side of radio.

Most of the AM activity is voluntarily restricted to small, specific portions of the bands. Close examination of most of the complaints about QRM, AM or otherwise, will reveal that someone was likely offended because another amateur dared to transmit on his self-proclaimed "private" frequency, which was probably idle at the time. Is it that some of the "state-of-the-art" rigs in use today lack vfo's and must operate crystal-controlled? Regardless of the mode in use, interference can be kept to an acceptable level simply by observing good operating procedures.

The AM community cordially invites all amateurs to listen in sometime. The most popular AM operating frequencies are: 1880–1900, 1985–90, 3870–85, 7285–95 kHz, and 29.0–29.2 MHz. You just might like what you hear and develop an urge to turn the mode switch on your "all-mode" transceiver to the AM position and fire up.

Donald Chester K4KYV is editor of The AM Press/Exchange, *a monthly newsletter devoted to AM operation.*

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

LOGIC PUZZLES

This month, for a change of pace, let's try our collective hands at some logic puzzles. While hams may not be the most logical bunch of people in the world (if we were logical, we wouldn't be clinging to the Morse code, right?), our technical skills do endow us with a certain degree of rationality. Anyway, logic puzzles make a nice break from the usual collection of multiple choice and matching questions. Have fun and don't think too hard.

QUESTIONS

1) Stan, an avid DXer, packs all of his QSLs into cartons that hold 16, 17, 23, 24, 39, and 40 pounds of cards. Old Stan's a little peculiar in that he will only use boxes of those sizes. He also fills each box to its full weight limit. Stan now wants to send 100 pounds of cards to the ARRL for DXCC credit. Tell us how many boxes and box sizes he will require. Oh yes, Stan has an unlimited supply of cartons of each size.

2) The president of the Skunkhaven Repeater Society took $60 out of his own wallet and purchased a supply of official club jacket patches. Fifteen of the patches were reserved for possible future members while the remainder were sold to the club's members for a total of $54, netting the president a 10-cent profit per patch. How many patches did the president purchase?

3) Last year's Rhode Island Sweepstakes was a fascinating and exciting single-operator competition—two solid weeks of contesting with only a two-hour break every 24 hours. Unfortunately, the lack of sleep eventually got to the participants and they all accidentally destroyed their logs (talk about a coincidence!). Luckily, however, each of the contesters was able to recall two aspects of the final results. Unluckily, though, most of the participants had lousy memories. When all was said and done, the only station that remembered two correct facts finished first. The only other contester to correctly recall a participant's final standing finished second. Your job is to determine the position of each station in the final standings.

N1ZAZ	KF1AM finished second WU1UU finished fifth
KF1AM	WU1UU finished first KT1RAX finished second
KT1RAX	NN1Z finished first WF1PU finished sixth
NN1Z	N1ZAZ finished first KT1RAX finished fourth
WF1PU	KF1AM finished fifth NN1Z finished third
WU1UU	WF1PU finished third N1ZAZ finished fourth

4) Herb and Dave are traffic handlers. Together they can handle 512 messages in 24 days. If Herb can only handle two-thirds as much traffic as Dave, how long would it take each of them to handle the messages alone?

5) It's Field Day! AF2M is a helpful young man who likes to help others erect their antennas. On this day, however, he was asked to pound some grounding rods in a circle around an antenna. AF2M discovered that if he pounded the rods one foot apart he would have 150 too few rods (it was a big array). If he placed the rods a yard apart he would have 70 too many. How many rods did AF2M need?

6) Three HTs and one VHF transceiver cost as much as two HF rigs. One HT, two VHF transceivers, and three HF rigs sell together for $2500. What is the price of each radio?

7) Frank owns two dummy loads: one for his multimode 2-meter rig, the other for his low-band transceiver. The VHF load is filled to one-third capacity with mineral oil. The low-band load, the same model and capacity as the VHF device, is filled to one-fourth capacity with mineral oil. Frank is cheap and insane, so he decides to bring each dummy load to capacity with transformer oil. He then empties the two loads into a large container and pours half the mixture into one of the empty dummy loads. Tell us what proportion of this mixture is mineral oil and what part transformer oil? (Note: the two oils mix perfectly, and please don't try this yourself!)

ANSWERS

1) Stan needs four 17-pound cartons and two 16-pound cartons.

2) The president bought 75 patches at 80 cents apiece ($60). After keeping 15 patches, he sold the remaining 60 for 90 cents apiece ($54). His profit, therefore, was 10 cents per patch on the 60 patches sold.

3) First—WF1PU, Second—WU1UU, Third—NN1Z, Fourth—N1ZAZ, Fifth—KF1AM, and Sixth—KT1RAX.

4) It would take them 60 days and 40 days.

5) AF2M needed 180 rods. The circumference of the circle was 330 feet.

6) The HT costs $200, the VHF transceiver $400, and the HF rig $500.

7) The concoction will be 7/24 mineral oil and 17/24 transformer oil.

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of July are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
JULY 1985

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1871	1	0900	180	31	158	28	130	16
1873	2	0800	165	31	145	25	121	9
1875	3	0700	152	29	133	20	112	2
1877	4	0700	147	24	130	14		
1879	5	0600	135	19	121	8		
1881	6	0500	125	13	112	1		
1883	7	0500	123	7				
1884	7	1600					249	0
1885	8	0400	114	1				
1886	8	1500					242	9
1888	9	1500					236	10
1890	10	1400			248	0	228	18
1892	11	1300			241	8	218	26
1894	12	1300			235	10	211	26
1896	13	1200	241	6	227	18	199	31
1898	14	1100	233	14	217	25	185	34
1900	15	1100	227	15	210	25	178	31
1902	16	1000	217	23	197	30	164	31
1904	17	0900	206	29	184	32	150	28
1906	18	0900	198	28	177	30	146	23
1908	19	0800	185	31	163	29	135	18
1910	20	0700	171	32	150	26	124	12
1912	21	0700	165	28	146	21	122	6
1914	22	0600	152	25	134	17	114	0
1916	23	0500	140	21	124	10		
1918	24	0500	137	16	122	5		
1920	25	0400	127	10	114	0		
1921	25	1500					252	0
1922	26	0300	117	3				
1923	26	1500					246	2
1924	27	1400					240	7
1926	28	1400					234	8
1929	29	1300			245	0	225	16
1931	30	1200			238	6	215	23
1933	31	1100	244	3	230	15	204	29

NEW PRODUCTS

HILDRETH ENGINEERING CW FILTER

The Model 10 Super CW audio filter is now available from Hildreth Engineering. Two modes of operation allow the user to select either a normal filter or a filter with signal-to-noise (S/N) enhancement. The audio filter is an eighth-order Butterworth with a 3-dB passband from 700 to 800 Hz, and a 3–30-dB shape factor of less than 3. The S/N enhancement function provides a 10-dB S/N ratio improvement over operation with just the audio filter. A 2-Watt audio amplifier is also included, which will drive a 4–8-Ohm speaker.

Further information may be obtained by writing *Hildreth Engineering Corp., PO Box 60003, Sunnyvale CA 94088.*

YAESU FRG-8800 RECEIVER

Yaesu's new FRG-8800 HF receiver covers 150 kHz through 29.99 MHz. Direct frequency entry is provided via the front-panel keyboard, which also controls scanning functions and storage/recall of the memory channels. The green LCD information display provides frequency, mode, and signal-strength information. Selectable agc, all-mode squelch, two 24-hour clocks, and recording capability (including on/off timer switching) make for maximum operating flexibility. The FRG-8800 is designed for easy interface with a personal computer for expanded operating control, and the FRV-8800 VHF Converter option expands coverage to include 118–174 MHz, with front-panel frequency entry and display.

For further information, contact *Yaesu Electronics Corporation, PO Box 49, Paramount CA 90723; (213)-633-4007.*

NITELOGGER VOICE-ACTIVATED INTERFACE

BMI, Inc., has announced the development of a new tape-recorder activator accessory designed to make recording scanner-radio activity easier and more convenient. NiteLogger™ plugs in between a scanner and any standard cassette recorder. No external relays or impedance-matching devices are needed. Voice-relay (VOX) operation permits recording of up to seven days or more of messages on a single C-90 cassette tape, depending on average channel use. NiteLogger includes a VOX-level LED indicator, which assures perfect adjustment, a VOX-delay control which minimizes dead tape time and annoying tape-recorder start/stop noises, and a built-in speaker system that allows monitoring of scanner reception during recording. The monitor's volume control is independent of the recording level so the user can select anything from full volume to silence without affecting the volume of recorded messages.

For more information, write *BMI, Inc., 65 East Palatine Road, Prospect Heights IL 60070.*

Yaesu's FRG-8800 communications receiver.

FREE TOOL AND INSTRUMENT CATALOG

Contact East is offering their 1985 electronic tool and test instrument catalog, featuring over 5,000 technical products for assembling, testing, and repairing electronic equipment. Products include precision hand tools, test instruments, tool kits, soldering supplies, and a full selection of telecommunication tools and instruments.

The Contact East 1985 catalog is available free from *Contact East, 7 Cypress Drive, PO Box 160, Burlington MA 01803; (617)-272-5051.*

ADTECH SWITCHING SUPPLY

Adtech Power has announced their newest Switcher Model Power Supply, the CS-1307. This 50-Watt, 3-output MOSFET supply uses a 50-kHz operating frequency in a fly-forward topology.

Many output combinations are available; a common combination is +5 V @ 4 Amps, +12 V @ 2 Amps, and −12 V @ 0.5 Amps. The standard size is 5.25″ × 3.75″ × 2.0″. A breakaway tab arrangement on the PCB allows users to reduce width to 3.25″ when space is a problem.

For more details, contact *Adtech Power, 1620 South Sunkist Street, Anaheim CA 92806.*

BRAILLE DISPLAY PROCESSOR

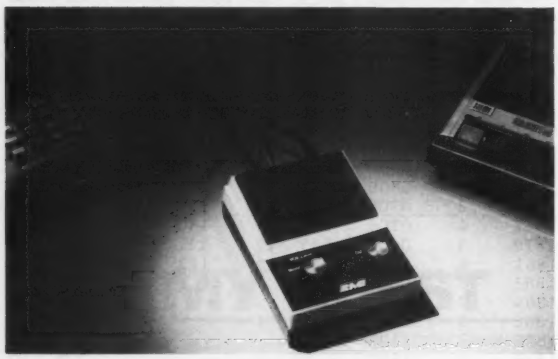
A device with an electronic braille display, providing instant personal-computer access for blind persons, has been developed by Visualtek, Inc., of Santa Monica, California. The Braille Display Processor (BDP) gives blind individuals easy access to column-oriented information useful for spreadsheet and programming applications, as well as a wide variety of other computer uses.

The BDP is available in two models: the BDP-20 for use with the Apple II, II+, or IIe, and the BDP-21 for use with the IBM PC and PC/XT, or compatible PCs. The BDP allows blind users to read the computer display on a 20-cell refreshable braille window in user-selectable 6- or 8-dot computer braille.

For more information, contact *Visualtek, 1610 26th St., Santa Monica CA 90404; (213)-829-6841.*

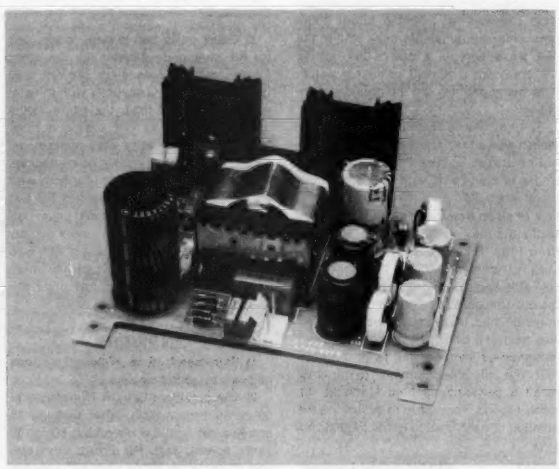
DAVLE TECH PC STATION

The Model PCBH-50 is a rugged printed-circuit-board holder and solder station designed especially for laboratory, prototype, and repair work as well as light production applications. Self-locking end supports slide easily to suit the board's width. The board holders are spring-loaded for easy board removal and replace-

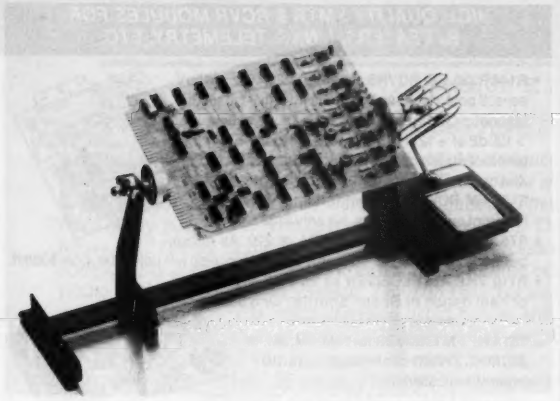


The BMI NiteLogger.

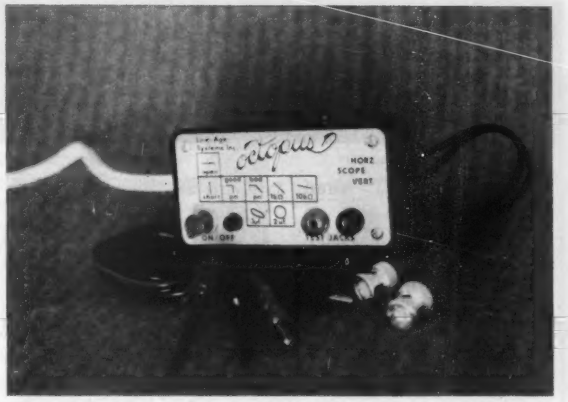
Visualtek's Braille Display Processor.



The Adtech CS-1307 switching power supply.



The PCBH-50 work station from Davie Tech.



The Octopus from Jensen Tools.

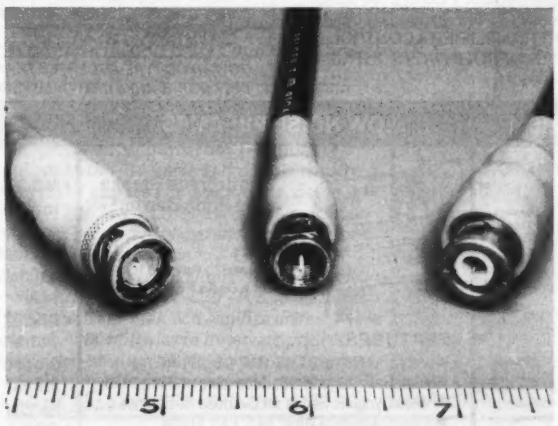
ment without readjustment. The board may be rotated a full 360° for easy access to both sides and may be locked at any angle for optimum efficiency. The PCBH-50 includes a specially-designed soldering iron holder which holds a soldering iron safely and a tip-cleaning sponge for added convenience and improved productivity. The unit is free-standing or may be mounted to a workbench. The PCBH-50 will hold boards up to 10 inches × 12 inches.

For more information, contact *Davie Tech, Inc., 2-05 Banta Place, Fair Lawn NJ 07410; (201)-796-1720.*

COMPU-FIRE EXTINGUISHER

The Compu-Fire™ is a rechargeable fire extinguisher for microcomputers, printers, and peripherals. Only 10 inches tall and weighing 2¼ pounds, the unit contains 20 ounces of Halon 1211, an agent which produces no static electricity upon discharge and which leaves no residue to harm electronic components. The extinguisher features a chrome-plated DOT steel cylinder, an aluminum valve assembly, and a pressure-indicating gauge. It carries a U.L. rating of 2B:C and a manufacturer's 5-year limited warranty. On the front of the cylinder are pictorial instructions for use, as well as a pictogram indicating its suitability for computer fires.

For further details, contact *Protectall Corp., 5422 Page Drive, Pittsburgh PA 15236; (412)-882-0114.*



Weather boots from Kilo-Tec.

KILO-TEC WEATHER BOOTS

Kilo-Tec is now offering weather-resistant boots for use with BNC, UHF, F, and N connectors on RG-58, RG-59, or RG-8X coaxial cable. The boots, designed to keep connections clean and dry, are made of a flexible vinyl material that resists moisture and that will not break down when exposed to the sun's rays. Custom boots are also available for other combinations of connectors and cables.

For more information, contact *Kilo-Tec, PO Box 1001, Oak View CA 93022.*

OCTOPUS TROUBLESHOOTER

Jensen Tools has announced the Octopus, a device which provides a fast, efficient method of troubleshooting electronic assemblies to the component level, both in and out of a circuit. When used in conjunction with a dual-trace oscilloscope having an X-Y function, or with a single-trace scope that accepts external horizontal-sweep output, the Octopus generates a 60-Hz sinusoidal test signal of approximately 3 V p-p. When this signal is applied to the component under test (resistor, capacitor, semiconductor, inductor, etc.) it will display the component's current/voltage response on the oscilloscope. By comparing a suspect component's trace to a good component's trace, the bad component can be quickly identified.

For more information or for a free catalog of other test equipment and hard-to-find tools for electronic assembly, troubleshooting, and repair, write or call *Jensen Tools, Inc., 7815 S. 46th Street, Phoenix AZ 85040; (602)-968-6231.*

UHF POWER AMP

AM-6155/GRT (ITT 3212) 225-400 Mhz RF amp, 50W output from 4-10W input using Eimac X651Z; silver-plated cavity in removable drawer. Requires 115/230 VAC & 20 VDC. 7x19½x18", 75 lbs. sh. Used-not tested, excellent condition: **$159.50**

AM-6154/GRT VHF POWER AMP, same as AM-6155 except covers 116-149.95 MHz range; used-not tested, ... **$209.50**

CU-872 HF ANTENNA COUPLER for up to eight 2-32 MHz receivers; 70 ohm output, N connections, test meter, and 20/6922 tubes. 7×9×16.5, 40 lbs sh. Used, ... **$49.50**

ZM-11 UNIVERSAL BRIDGE, measures 10 pf-1100 mf Capacitance, 0.1 mH-110 H Inductance, Insulation DC Resistance, Transformer Turns Ratio, DC Leakage, Dissipation, and Q Storage. 115 VAC 60 Hz; 5.8×9×9.8, 18 lbs sh. Used-checked, ... **$115.00;** Manual partial repro, ... **$8.50**

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Band	Kit	Wired
10M,6M, 2M,220	$680	$880
440	$780	$980

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- SENSITIVITY SECOND TO NONE; 0.15 uV (VHF), 0.2 uV (UHF) TYP.
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- OTHER GREAT RECEIVER FEATURES: FLUTTER-PROOF SQUELCH, AFC TO COMPENSATE FOR OFF-FREQ TRANSMITTERS, SEPARATE LOCAL SPEAKER AMPLIFIER & CONTROL.
- CLEAN, EASY TUNE TRANSMITTER; UP TO 20 WATTS OUT (UP TO 50W WITH OPTIONAL PA).

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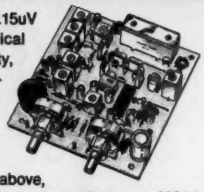
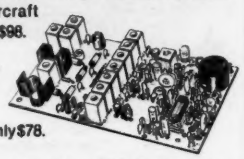


- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.; 8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity, > 100 dB at ± 12 kHz, best available today. Flutter-proof squelch. AFC tracks drifting xmtrs. Xtal oven avail. Kit only $138.
- **R451 FM RCVR** Same but for uhf. Tuned line front end, 0.3 uV sens. Kit only $138.
- **R76 FM RCVR** for 10M, 6M, 2M, or 220. As above, but w/o AFC or hel. res. Kits only $118. Also avail w/4 pole filter, only $98/kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft or ham bands or Space Shuttle. Only $98.



- **T51 VHF FM EXCITER** for 10M, 6M, 2M, or 220 MHz. 2 Watts continuous, up to 3 W intermittent. $68/kit.
- **T451 UHF FM EXCITER** 2 to 3 Watts. Kit only $78. Xtal oven avail.
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RECEIVING CONVERTERS

Models to cover every practical rf & if range to listen to SSB, FM, ATV, etc. NF = 2 dB or less.

Antenna Input Range	Receiver Output
28–32	144–148
50–52	28–30
50–54	144–148
144–146	28–30
145–147	28–30
144–144.4	27–27.4
146–148	28–30
144–148	50–54
220–222	28–30
220–224	144–148
222–226	144–148
220–224	50–54
222–224	28–30

VHF MODELS

Kit with Case	$49
Less Case	$39
Wired	$69

UHF MODELS

Kit with Case	$59
Less Case	$49
Wired	$75

Antenna Input Range	Receiver Output
432–434	28–30
435–437	28–30
432–436	144–148
432–436	50–54
439.25	61.25

SCANNER CONVERTERS Copy 806 MHz band on any scanner. Wired/tested ONLY $88.

TRANSMIT CONVERTERS

For SSB, CW, ATV, FM, etc. Why pay big bucks for a multi mode rig for each band? Can be linked with receive converters for transceive. 2 Watts output vhf, 1 Watt uhf.

For VHF, Model XV2 Kit $79 Wired $149 (Specify band)

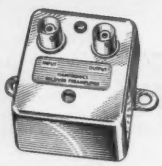
For UHF, Model XV4 Kit $99 Wired $169

Exciter Input Range	Antenna Output
28-30	144-146
28-29	145-146
28-30	50-52
27-27.4	144-144.4
28-30	220-222*
50-54	220-224
144-146	50-52
50-54	144-148
144-146	28-30
28-30	432-434
28-30	435-437
50-54	432-436
61.25	439.25
144-148	432-436*

*Add $20 for 2M input

VHF & UHF LINEAR AMPLIFIERS. Use with above. Power levels from 10 to 45 Watts. Several models, kits from $78.

LOW-NOISE PREAMPS



Hamtronics Breaks the Price Barrier!

*

No Need to Pay $80 to $125 for a GaAs FET Preamp.

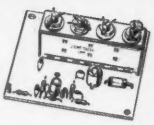
FEATURES:

- Very Low Noise: 0.7 dB VHF, 0.8 dB UHF
- High Gain: 18 to 28 dB, Depending on Freq.
- Wide Dynamic Range for Overload Resistance
- Latest Dual-gate GaAs FET, Very Stable

MODEL	TUNES RANGE	PRICE
LNG-28	26-30 MHz	$49
LNG-50	46-56 MHz	$49
LNG-144	137-150 MHz	$49
LNG-160	150-172 MHz	$49
LNG-220	210-230 MHz	$49
LNG-432	400-470 MHz	$49
LNG-800	800-960 MHz	$49

HELICAL RESONATOR PREAMPS

Low-noise preamps with helical resonators reduce intermod and cross-band interference in critical applications. 12 dB gain.



Model	Tuning Range	Price
HRA-144	143-150 MHz	$49
HRA-220	213-233 MHz	$49
HRA-432	420-450 MHz	$59
HRA-( )	150-174 MHz	$54
HRA-( )	450-470 MHz	$64

ACCESSORIES

- **MO-202 FSK DATA MODULATOR.** Run up to 1200 baud digital or packet radio signals through any FM transmitter. Automatically keys transmitter and provides handshakes. 1200/2200 Hz tones. Kit only $45.
- **DE-202 FSK DATA DEMODULATOR.** Use with any FM receiver to detect packet radio or other digital data in "202" modem format. Provides audio conditioning and handshakes. Kit only $38.
- **COR-2 KIT** With audio mixer, local speaker amplifier, tail & time-out timers. Only $38.
- **COR-3 KIT** as above, but with "courtesy beep". Only $58.
- **CWID KITS** 158 bits, easily field programmable, clean audio. Kit only $68.
- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 × 8 × 2 inches. Designed especially for repeaters. $20.
- **DTMF DECODER/CONTROLLER KITS.** Control 2 separate on/off functions with touchtones®, e.g., repeater and autopatch. Use with main or aux. receiver or with Autopatch. Only $90
- **AUTOPATCH KITS.** Provide repeater autopatch, reverse patch, phone line remote control of repeater, secondary control via repeater receiver. Many other features. Only $90. Requires DTMF Module.
- **SIMPLEX AUTOPATCH.** Use with your FM transceiver. System includes DTMF & Autopatch modules above and new Timing module to provide simplex autopatch and reverse autopatch. Complete patch system only $200/kit. Call or write for details.

- **Call or Write for FREE CATALOG**
  (Send $2.00 or 4 IRC's for overseas mailing)
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  (Electronic answering service evenings & weekends)
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Phone: 716-392-9430

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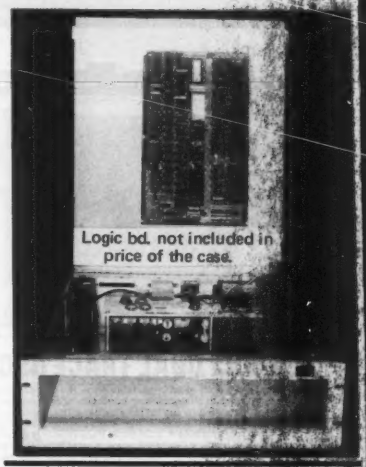
John J. Meshna Jr., Inc.

P. O. Box 62 19 Allerton St. E. Lynn, Ma. 01904 Tel: (617) 595-2275

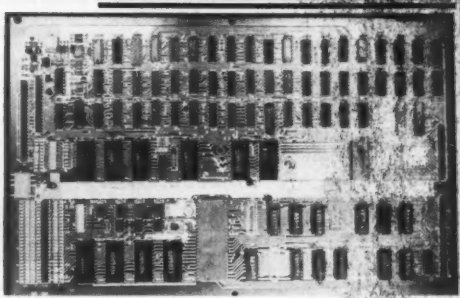
Dual 8" F. D. D. Case by SMS w/ POWER ONE Power Supply & Cooling Fans

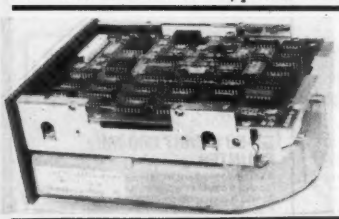
We were very fortunate to find these beautifully designed & constructed rack mount disc drive cases in the surplus field. These cases were made for Scientific Micro Systems for their FT Series of equipment. They are manufactured from heavy guage steel w/ a cast metal designer bezel. They were designed to house 2 8" floppy or hard drives. We offer you the case with the following components & features: hinged cover with restraining cable for simplified servicing of the interior components, 2 muffin fans for assured cool operation, studs for mounting the controller card listed below, and a heavy duty Power One power supply (their model no. CP 281A). The outputs of the power supply are as follows: +5 vdc 11 amps, +24 vdc 3.5 amps, +12 vdc .25 amps, -12 vdc .25 amps, & -5 vdc .25 amps. The input to the power supply is 115/230 vac 50/60 Hz. and is both filtered and fused. This assembly must have originally sold for well over $300.00 each ! Only 25 on hand, so order early or be left out on this super bargain ! Shpg. wt. 38 lb. SPL-479-35 $135.00 each



Scientific Micro Systems IBM 3740 Compatible 8" FDD Controller Card

The SMS FD 0502 8" floppy disc drive controller is a complete preprogrammed controller for single or double density recording on either single or dual headed disc drives. It performs control functions required to transfer data between 1 to 4 drives and a host system, performs all formatting functions required to read and write data and utilizes both IBM single and double density standards to achieve up to 630 Kilobytes of storage per disc surface. Some features are: programmable sector size, 128, 256, 512, or 1024 bytes, jumper selectable drive type, block transfer mode, sector buffer, overlapped head seek, on board General Purpose Host Interface with asynchronous 19 TTL signal lines for eight bit host system and input of only 5 vdc 6 amps. This board provides a direct interface to the following drives: Shugart 800-2/850, Pertec 511, Memorex 550/552, MFE 751B, Qume Data Trak and similiar drives. These boards were removed from the above cabinets which were in service prior to our reception of them. The manufacturers price on these IBM compatible boards is currently $900.00 each. These boards all appear to be in excellent condition. If more information is needed, please call us. Shpg. wt. 3 lb. SPL 480 $150.00

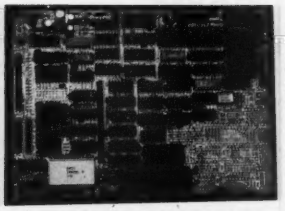




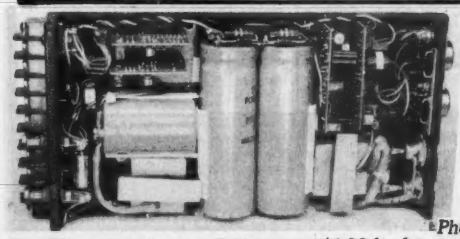
SEAGATE TECHNOLOGY ST 506 5¼" HARDRIVES

The Seagate Technology ST 506 hard disc drive utilizes proven Winchester technology for reliable storage of up to 5 megabytes of formatted data. Some features of this very popular drive are: 5 megabit/second data transfer rate, simple floppy like interface, high speed band actuator & stepper head positioning, requires only +5 & +12 vdc, and same physical size and mounting parameters as a mini floppy drive. This Shugart compatible drive is the same as used on many home personal computers. Each drive is checked out prior to shipment. Comes with data. Will run with OMTI controller board, listed below. Only a few on hand, so order early. Shpg. wt. 8lb. ST-506 . . . . . $175.00

5 ¼" HARD DRIVE CONTROLLER CARD



Finally, affordable, intelligent disc drive controllers are available at low, low surplus prices. The OMTI 20C controller boards we offer are unused, late style, surplus from a now defunct system house. OMTI is a division of Scientific Micro Systems. These boards will handle up to (2) 5¼ inch Winchester type hard drives that utilize a standard 34 pin SASI interface. Perfect for using with the above Seagate ST 506 drive, or other hard drives from 5 megabytes of storage on up. The controllers have buffered slew/seek modes, overlapped seeks, auto seek & verify, extensive fault detection, auto head & cylinder switching, full sector buffering, 256/512 bytes/sector, 33 or 18 sectors/track (jumper selectable), programmable disc parameters and much more. The board runs on +5 vdc & +12 vdc.. We supply users manual & pinout data. Guaranteed O. K.. Shpg. wt. 3 lb. OMTI 20 C $150.00 each 2/$275.00 Qty. pricing available.



5 VDC 25 AMP SWITCHING POWER SUPPLY

We just got in a small lot of ruggedly built, lightweight (4 lb.), compact (11" x 5" x 1½"), fully enclosed (cover removed for pic.), regulated, switching, power supplies made by RO Industries. Input of 115/230 vac is attached thru convenient, clearly marked screw terminals. The hefty 5 vdc 25 amp output is via heavy duty, brass lugs with a Red LED status indicator. All appear to be unused and in excellent condition. Shpg. wt. 6 lb. PS-8 $50.00

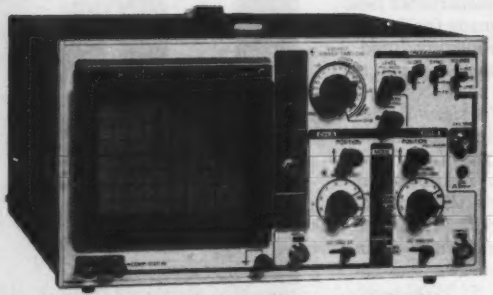
Phone (617) 595-2275 to place your order by phone. MC, VISA or American Express charge cards accepted.

Free 72 page catalogue available or send $1.00 for 1st class service to P. O. Box 62 E. Lynn, Ma. 01904.

"When You Buy, Say 73"

RAMSEY

THE FIRST NAME IN ELECTRONIC TEST GEAR

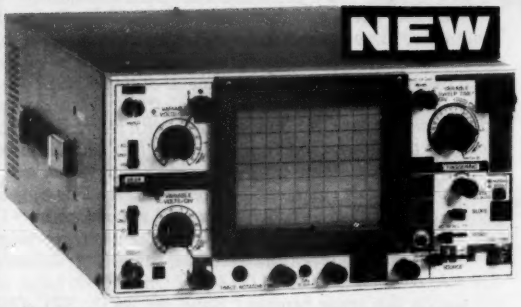


20 MHz DUAL TRACE OSCILLOSCOPE

Unsurpassed quality at an unbeatable price, the Ramsey oscilloscope compares to others costing hundreds more. Features include a component testing circuit for resistor, capacitor, digital circuit and diode testing. • TV video sync filter • wide bandwidth & high sensitivity • internal graticule • front panel trace rotator • Z axis • high sensitivity x-y mode • regulated power supply • built-in calibrator • rock solid triggering

$399.95* high quality hook on probes included

* USA—Add $10.00 per unit for postage, overseas orders add 15% of total order for Insured Surface Mail



45 MHz DUAL SWEEP OSCILLOSCOPE

The Ramsey 625 is a dual time base, delayed sweep unit that includes a built-in signal delay line to permit clear viewing during very short rise times of high frequency waveforms. Other features include: variable trigger holdoff • 20 calibrated sweep time ranges from 0.5 s/div to 0.2 µS/div. • fully adjustable sweep time • X5 sweep magnification • five trigger sources; CH1, CH2, LINE EXTernal and INTernal (V mode) • front panel x-y operation, Z axis input • sum difference of CH1, and CH2 waveforms displayed as single trace • sweep gate and sweep output • auto focus • single sweep

$799.95* high quality hook on probes included

* USA—Add $10.00 per unit for postage, overseas orders add 15% of total order for Insured Surface Mail.

RAMSEY D-1100 VOM MULTITESTER

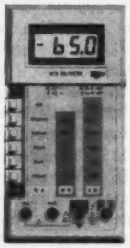
Compact and reliable, designed to service a wide variety of equipment. Features include • mirror back scale • double-jeweled precision moving coil • double overload protection • an ideal low cost unit for the beginner or as a spare back-up unit.

$19.95 test leads and battery included

NEW RAMSEY 1200 VOM MULTITESTER

Check transistors, diodes and LEDs with this professional quality meter. Other features include: decibel scale • 20K volt metering system • 3½" mirrored scale • polarity switch • 20 measuring ranges • safety probes • high impact plastic case

$24.95 test leads and battery included



RAMSEY D-3100 DIGITAL MULTIMETER

Reliable, accurate digital measurements at an amazingly low cost • in-line color coded push buttons, speeds range selection • abs plastic tilt stand • recessed input jacks • overload protection on all ranges • 3½ digit LCD display with auto zero, auto polarity & low BAT. indicator

$49.95 test leads and battery included

CT-70 7 DIGIT 525 MHz COUNTER

Lab quality at a breakthrough price. Features • 3 frequency ranges each with pre amp • dual selectable gate times • gate activity indicator • 50mV @ 150 MHz typical sensitivity • wide frequency range • 1 ppm accuracy

$119.95 wired includes AC adapter

CT-70 kit $99.95
BP-4 nicad pack 8.95

CT-90 9 DIGIT 600 MHz COUNTER

The most versatile for less than $300. Features 3 selectable gate times • 9 digits • gate indicator • display hold • 25mV @ 150 MHz typical sensitivity • 10 MHz timebase for WWV calibration • 1 ppm accuracy

$149.95 wired includes AC adapter

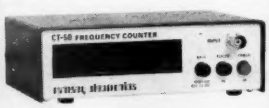
CT-90 kit $129.95
OV-1 0.1 PPM oven timebase 59.95
BP-4 nicad pack 8.95

CT-125 9 DIGIT 1.2 GHz COUNTER

A 9 digit counter that will outperform units costing hundreds more. • gate indicator • 24mV @ 150 MHz typical sensitivity • 9 digit display • 1 ppm accuracy • display hold • dual inputs with preamps

$169.95 wired includes AC adapter

BP-4 nicad pack 8.95



CT-50 8 DIGIT 600 MHz COUNTER

A versatile lab bench counter with optional receive frequency adapter, which turns the CT-50 into a digital readout for most any receiver • 25 mV @ 150 MHz typical sensitivity • 8 digit display • 1 ppm accuracy

$169.95 wired

CT-50 kit $139.95
RA-1 receiver adapter kit 14.95

DM-700 DIGITAL MULTIMETER

Professional quality at a hobbyist price. Features include 26 different ranges and 5 functions • 3½ digit, ½ inch LED display • automatic decimal placement • automatic polarity

$119.95 wired includes AC adapter

DM-700 kit $99.95
MP-1 probe set 4.95

PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements, multiplies UP in frequency • great for PL tone measurements • multiplies by 10 or 100 • 0.01 Hz resolution & built-in signal preamp/conditioner

$49.95 wired

PS-2 kit $39.95

PR-2 COUNTER PREAMP

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for shifting RF • ideal receiver/TV preamp

$44.95 wired includes AC adapter

PR-2 kit $34.95

PS-1B 600 MHz PRESCALER

Extends the range of your present counter to 600 MHz • 2 stage preamp • divide by 10 circuitry • sensitivity: 25mV @ 150 MHz • BNC connectors • drives any counter

$59.95 wired includes AC adapter

PS-1B kit $49.95

ACCESSORIES FOR RAMSEY COUNTERS

Telescopic whip antenna—BNC plug	$ 8.95
High impedance probe, light loading	16.95
Low pass probe, audio use	16.95
Direct probe, general purpose use	13.95
Tilt bail, for CT-70, 90, 125	3.95

VISA MasterCard

PHONE ORDERS CALL
716-586-3950
TELEX 466735 RAMSEY CI

TERMS: • satisfaction guaranteed • examine for 10 days, if not pleased, return in original form for refund • add 5% for shipping and insurance to a maximum of $10.00 • overseas add 15% for surface mail • COD add $2.50 (COD in USA only) • orders under $15.00 add $1.50 • NY residents add 7% sales tax • 90 day parts warranty on all kits • 1 year parts & labor warranty on all wired units.

RAMSEY

RAMSEY ELECTRONICS, INC.
2575 Baird Rd.
Penfield, N.Y. 14626

TUBES

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2C39/7289	$ 34.00	1182/4600A	$500.00	ML7815AL	$ 60.00
2E26	7.95	4600A	500.00	7843	107.00
2K28	200.00	4624	310.00	7854	130.00
3-500Z	102.00	4657	84.00	ML7855KAL	125.00
3-1000Z/8164	400.00	4662	100.00	7984	14.95
3B28/866A	9.50	4665	500.00	8072	84.00
3CX400U7/8961	255.00	4687	P.O.R.	8106	5.00
3CX1000A7/8283	526.00	5675	42.00	8117A	225.00
3CX3000F1/8239	567.00	5721	250.00	8121	110.00
3CW30000H7	1700.00	5768	125.00	8122	110.00
3X2500A3	473.00	5819	119.00	8134	470.00
3X3000F1	567.00	5836	232.50	8156	12.00
4-65A/8165	69.00	5837	232.50	8233	60.00
4-125A/4D21	79.00	5861	140.00	8236	35.00
4-250A/5D22	98.00	5867A	185.00	8295/PL172	500.00
4-400A/8438	98.00	5868/AX9902	270.00	8458	35.00
4-400B/7527	110.00	5876/A	42.00	8462	130.00
4-400C/6775	110.00	5881/6L6	8.00	8505A	95.00
4-1000A/8166	444.00	5893	60.00	8533W	136.00
4CX250B/7203	54.00	5894/A	54.00	8560/A	75.00
4CX250FG/8621	75.00	5894B/8737	54.00	8560AS	100.00
4CX250K/8245	125.00	5946	395.00	8608	38.00
4CX250R/7580W	90.00	6083/AZ9909	95.00	8624	100.00
4CX300A/8167	170.00	6146/6146A	8.50	8637	70.00
4CX350A/8321	110.00	6146B/8298	10.50	8643	83.00
4CX350F/8322	115.00	6146W/7212	17.95	8647	168.00
4CX350FJ/8904	140.00	6156	110.00	8683	95.00
4CX600J/8809	835.00	6159	13.85	8877	465.00
4CX1000A/8168	242.50*	6159B	23.50	8908	13.00
4CX1000A/8168	485.00	6161	325.00	8950	13.00
4CX1500B/8660	555.00	6280	42.50	8930	137.00
4CX5000A/8170	1100.00	6291	180.00	6L6 Metal	25.00
4CX10000D/8171	1255.00	6293	24.00	6L6GC	5.03
4CX15000A/8281	1500.00	6326	P.O.R.	6CA7/EL34	5.38
4CW800F	710.00	6360/A	5.75	6CL6	3.50
4D32	240.00	6399	540.00	6DJ8	2.50
4E27A/5-125B	240.00	6550A	10.00	6DQ5	6.58
4PR60A	200.00	6883B/8032A/8552	10.00	6GF5	5.85
4PR60B	345.00	6897	160.00	6GJ5A	6.20
4PR65A/8187	175.00	6907	79.00	6GK6	6.00
4PR1000A/8189	590.00	6922/6DJ8	5.00	6HB5	6.00
4X150A/7034	60.00	6939	22.00	6HF5	8.73
4X150D/7609	95.00	7094	250.00	6JG6A	6.28
4X250B	45.00	7117	38.50	6JM6	6.00
4X250F	45.00	7203	P.O.R.	6JN6	6.00
4X500A	412.00	7211	100.00	6JS6C	7.25
5CX1500A	660.00	7213	300.00*	6KN6	5.05
KT88	27.50	7214	300.00*	6KD6	8.25
416B	45.00	7271	135.00	6LF6	7.00
416C	62.50	7289/2C39	34.00	6LQ6 G.E.	7.00
572B/T160L	49.95	7325	P.O.R.	6LQ6/6MJ6 Sylvania	9.00
592/3-200A3	211.00	7360	13.50	6ME6	8.90
807	8.50	7377	85.00	12AT7	3.50
811A	15.00	7408	2.50	12AX7	3.00
812A	29.00	7609	95.00	12BY7	5.00
813	50.00	7735	36.00	12JB6A	6.50

NOTE * = USED TUBE

NOTE P.O.R. = PRICE ON REQUEST

"ALL PARTS MAY BE NEW, USED, OR SURPLUS. PARTS MAY BE SUBSTITUTED WITH COMPARABLE PARTS IF WE ARE OUT OF STOCK OF AN ITEM.

NOTICE: ALL PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

For information call: (602) 265-0731

Toll Free Number
800-528-0180
(For orders only)

"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

MHz electronics

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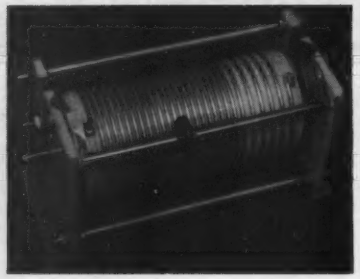
E.F. JOHNSON ROLLER INDUCTORS

MODEL 229-0201-01
10UH at 3AMPS MAX. $36.99



MODEL 229-0202-01
18UH at 5AMPS MAX. $44.99

****

UNELCO,SEMCO,ARCO METAL CLAD MICA CAPACITORS

Standard Size					Micro Size	
3.9	14	33	62	175	5	25
4.7	15	34	68	180	6	27
5	18	36	75	200	7	33
5.1	20	38	80	220	8	36
6.8	22	39	82	240	9	51
7	24	40	100	250	12	62
8.2	25	43	110	300	15	
9.1	27	44	120	360	16	
10	27.5	47	123	470	18	
11	28	50	125	500	20	
12	30	51	140	820	22	
13	32	56	150	1000	24	

********NOTE ALL VALUES LISTED IN PICO FARAD********

PRICE INFORMATION
1 to 10 $ .90ea. 11 to 51 $.80ea. 52 to 102 $.70ea.
103 and up call

****

GOULD NI-CAD BATTERIES

AA size 1.25v at 500mahr	new	a	$ 1.99
D size 1.25v at 4 AMPHR	new	h	7.49

GENERAL ELECTRIC NI-CAD BATTERIES

AA size 1.25v at 500mahr	new	a	2.99
195194 3.75v at 100mahr	new		1.99
AA size 3.75v at 100mahr	new	a	2.99
AA size pack of 10 12.5v at 450mahr	used	a	5.99
Sub C Pack of 10 12.5v at 2.5Amphr	new	c	9.99

UNION CARBIDE NI-CAD BATTERIES

193817 3.75v at 225mahr	new	a	2.99

GLOBE GEL-CELL BATTERIES

2v at 8AMPHR GC280	new	g	5.99
12v at 20AMPHR GC12200	new	g	49.99
12v at 23AMPHR GC12300	new	g	54.99

EAGLE PICHER GEL-CELL BATTERIES

12v at 1.5AMPHR CF12V1.5	new	d	11.99

GATES SEALED RECHARGEABLE LEAD ACID BATTERIES AND PACKS

2v at 2.5AMPHR D Cell	new	b	5.99
8v at 5AMPHR 4 X Cell	used	f	14.99
12v at 2.5AMPHR 6 D Cells	new	f	24.99
18v at 2.5AMPHR 9 D Cells	new	f	29.99

GENERAL ELECTRIC SEALED REACHARABLE LEAD ACID BATTERIES AND PACKS

6v at 2.5AMPHR 3 D Cells	used	e	10.00
12v at 2.5AMPHR 6 D Cells	used	e	19.99
12v at 5AMPHR 6 X Cells	used	e	24.99

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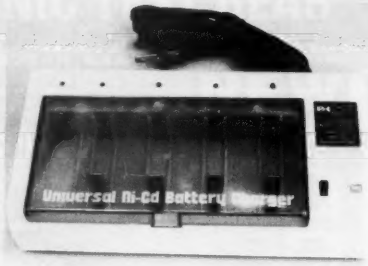
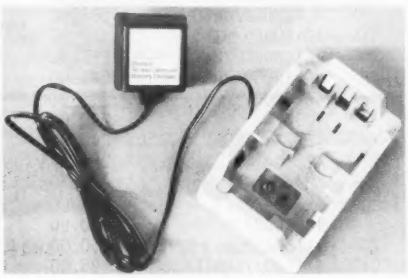
NI-CAD BATTERY CHARGERS



UNIVERSAL CHARGER $19.99

MALLORY CHARGER $23.99



EVEREADY CHARGER $9.99

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3802 North 27th Ave., Phoenix, AZ 85017
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RF TRANSISTORS

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2N1561	$25.00	2N5920	$ 70.00	40608 RCA	$ 2.48	BFY90	$ 1.50
2N1562	25.00	2N5921	80.00	40673 RCA	2.50	BLW60C5	15.00
2N1692	25.00	2N5922	10.00	40894 RCA	1.00	BLX67	12.25
2N2857	1.55	2N5923	25.00	60247 RCA	25.00	BLX67C3	12.25
2N2857JAN	4.10	2N5941	23.00	61206 RCA	100.00	BLX93C3	22.21
2N2857JANTX	4.50	2N5942	40.00	62800A RCA	60.00	BLY87A	7.50
2N2876	13.50	2N5944	10.35	62803 RCA	100.00	BLY88C3	13.08
2N2947	18.35	2N5945	10.00	430414/3990RCA	50.00	BLY89C	13.00
2N2948	13.00	2N5946	12.00	3457159 RCA	20.00	BLY90	45.00
2N2949	15.50	2N5947	9.20	3729685-2 RCA	75.00	BLY92	13.30
2N3118	5.00	2N6080	6.00	3729701-2 RCA	50.00	BLY94C	45.00
2N3119	4.00	2N6081	7.00	3753883 RCA	50.00	BLY351	10.00
2N3134	1.15	2N6082	9.00	615467-902	25.00	BLY568C/CF	30.00
2N3287	4.90	2N6083	9.50	615467-903	40.00	C2M70-28R	92.70
2N3288	4.40	2N6084	12.00	2SC568	2.50	C25-28	57.00
2N3309	4.85	2N6094	11.00	2SC703	36.00	C4005	2.50
2N3375	17.10	2N6095	12.00	2SC756A	7.50	CD1659	20.00
2N3478	2.13	2N6096	16.10	2SC781	2.80	CD1899	20.00
2N3553	1.55	2N6097	20.70	2SC1018	1.00	CD1920	10.00
2N3553JAN	2.90	2N6105	21.00	2SC1042	24.00	CD2188	18.00
2N3632	15.50	2N6136	21.85	2SC1070	2.50	CD2545	24.00
2N3733	11.00	2N6166	40.24	2SC1216	2.50	CD2664A	16.00
2N3818	5.00	2N6267	142.00	2SC1239	2.50	CD3167	92.70
2N3866	1.30	2N6304	1.50	2SC1251	24.00	CD3353	95.00
2N3866JAN	2.20	2N6368	30.00	2SC1306	2.90	CD3435	26.30
2N3866JANTX	3.80	2N6439	55.31	2SC1307	5.50	CD3900	152.95
2N3866JANTXV	4.70	2N6459	18.00	2SC1424	2.80	CM25-12	20.00
2N3866AJANTXV	5.30	2N6567	10.06	2SC1600	5.00	CM40-12	27.90
2N3924	3.35	2N6603	13.50	2SC1678	2.00	CM40-28	56.90
2N3926	16.10	2N6604	13.50	2SC1729	32.40	CME50-12	30.00
2N3927	17.25	2N6679	44.00	2SC1760	1.50	CTC2001	42.00
2N3948	1.75	2N6680	80.00	2SC1909	4.00	CTC2005	55.00
2N3950	25.00	021-1	15.00	2SC1945	10.00	CTC3005	70.00
2N3959	3.85	01-80703T4	65.00	2SC1946	40.00	CTC3460	20.00
2N4012	11.00	35C05	15.00	2SC1947	10.00	DV2820S	25.00
2N4037	2.00	102-1	28.00	2SC1970	2.50	DXL1003P70	22.00
2N4041	14.00	103-1	28.00	2SC1974	4.00	DXL2001P70	19.00
2N4072	1.80	103-2	28.00	2SC2166	5.50	DXL2002P70	14.00
2N4080	4.53	104P1	18.00	2SC2237	32.00	DXL3501AP100F	47.00
2N4127	21.00	163P1	10.00	2SC2695	47.00	EFJ4015	12.00
2N4416	2.25	181-3	15.00	A2X1698	POR	EFJ4017	24.00
2N4427	1.25	210-2	10.00	A3-12	14.45	EFJ4021	24.00
2N4428	1.85	269-1	18.00	A50-12	24.00	EFJ4026	35.00
2N4430	11.80	281-1	15.00	A209	10.00	EN15745	20.00
2N4927	3.90	282-1	30.00	A283	6.00	FJ9540	16.00
2N4957	3.45	482	7.50	A283B	6.00	FSX52WF	58.00
2N4959	2.30	564-1	25.00	A1610	19.00	G65739	25.00
2N5016	18.40	698-3	15.00	AF102	2.50	G65386	25.00
2N5026	15.00	703-1	15.00	AFY12	2.50	GM0290A	2.50
2N5070	18.40	704	4.00	AR7115	20.00	HEP76	4.95
2N5090	13.80	709-2	11.00	AT41435-5	6.35	HEPS3002	11.40
2N5108	3.45	711	4.00	B2-8Z	10.70	HEPS3003	30.00
2N5109	1.70	733-2	15.00	B3-12	10.85	HEPS3005	10.00
2N5160	3.45	798-2	25.00	B12-12	15.70	HEPS3006	19.90
2N5177	21.62	3421	28.00	BAL0204125	152.95	HEPS3007	25.00
2N5179	1.04	3683P1	15.00	BF25-35	56.25	HEPS3010	11.34
2N5216	56.00	3992	25.00	B40-12	19.25	HF8003	10.00
2N5470	75.00	4164P1	15.00	B70-12	55.00	HFET2204	112.00
2N5583	3.45	4243P1	28.00	BF272A	2.50	HP35821	38.00
2N5589	9.77	4340P3	18.00	BFQ85	2.50	HP35826B	32.00
2N5590	10.92	4387P1	27.50	BFR21	2.50	HP35826E	32.00
2N5591	13.80	7104-1	28.00	BFR90	1.00	HP35831E	30.00
2N5596	99.00	7249-2	10.50	BFR91	1.65	HP35832E	50.00
2N5636	12.00	7283-1	37.50	BFR99	2.50	HP35833E	50.00
2N5637	15.50	7536-1	30.00	BFT12	2.50	HP35859E	75.00
2N5641	12.42	7794-1	10.50	BFW16A	2.50	HP35866E	44.00
2N5642	14.03	7795	15.00	BFW17	2.50	HXTR2101	44.00
2N5643	25.50	7795-1	15.00	BFW92	1.50	HXTR3101	7.00
2N5645	13.80	7796-1	24.00	BFX44	2.50	HXTR5101	31.00
2N5646	20.70	7797-1	36.00	BFX48	2.50	HXTR6104	68.00
2N5651	11.05	40081 RCA	5.00	BFX65	2.50	HXTR6105	31.00
2N5691	18.00	40279 RCA	10.00	BFX84	2.50	HXTR6106	33.00
2N5764	27.00	40280 RCA	4.62	BFX85	2.50	J310	1.00
2N5836	3.45	40281 RCA	10.00	BFX86	2.50	J02000	10.00
2N5842	8.45	40282 RCA	20.00	BFX89	1.00	J02001	25.00
2N5847	19.90	40290 RCA	2.80	BFY11	2.50	J04045	24.00
2N5849	20.00	40292 RCA	13.05	BFY18	2.50	KD5522	25.00
2N5913	3.25	40294 RCA	2.50	BFY19	2.50	KJ5522	25.00
2N5916	36.00	40341 RCA	21.00	BFY39	2.50	M1106	13.75

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M1107	$16.75	MRF458	$20.70	NE02160ER	$100.00	SD1009	$15.00
M1131	5.15	MRF464	25.30	NE021350	5.30	SD1009-2	15.00
M1132	7.25	MRF466	18.97	NE13783	61.00	SD1012	10.00
M1134	13.40	MRF472	1.50	NE21889	43.00	SD1012-3	10.00
M9116	29.10	MRF475	3.10	NE57835	5.70	SD1012-5	10.00
M9579	6.00	MRF476	3.16	NE64360ER-A	100.00	SD1013	10.00
M9580	7.95	MRF477	20.00	NE64480 (B)	94.00	SD1013-3	10.00
M9587	7.00	MRF479	8.05	NE73436	2.50	SD1013-7	10.00
M9588	5.20	MRF492	23.00	NE77362ER	100.00	SD1016	15.00
M9622	5.95	MRF502	1.04	NE98260ER	100.00	SD1016-5	15.00
M9623	7.95	MRF503	6.00	PRT8637	25.00	SD1018-4	13.00
M9624	9.95	MRF504	7.00	PT3127A	5.00	SD1018-6	13.00
M9625	15.95	MRF509	5.00	PT3127B	5.00	SD1018-7	13.00
M9630	14.00	MRF511	10.69	PT3127C	20.00	SD1018-15	13.00
M9740	27.90	MRF515	2.00	PT3127D	20.00	SD1020-5	10.00
M9741	27.90	MRF517	2.00	PT3127E	20.00	SD1028	15.00
M9755	16.00	MRF525	3.45	PT3190	20.00	SD1030	12.00
M9780	5.50	MRF559	1.76	PT3194	20.00	SD1030-2	12.00
M9827	11.00	MRF587	11.00	PT3195	20.00	SD1040	5.00
M9848	35.00	MRF605	20.00	PT3537	7.80	SD1040-2	20.00
M9850	13.50	MRF618	25.00	PT4166E	20.00	SD1040-4	10.00
M9851	20.00	MRF626	12.00	PT4176D	25.00	SD1040-6	5.00
M9860	8.25	MRF628	8.65	PT4186B	5.00	SD1043	12.00
M9887	2.80	MRF629	3.45	PT4209	25.00	SD1043-1	10.00
M9908	6.95	MRF641	25.30	PT4209C/5645	25.00	SD1045	3.75
M9965	12.00	MRF644	27.60	PT4556	24.60	SD1049-1	2.00
MM1500	25.00	MRF646	29.90	PT4570	7.50	SD1053	4.00
MM1550	10.00	MRF648	33.35	PT4577	20.00	SD1057	10.00
MM1552	50.00	MRF816	15.00	PT4590	5.00	SD1065	4.75
MM1553	50.00	MRF823	20.00	PT4612	20.00	SD1068	15.00
MM1607	8.45	MRF846	44.85	PT4628	20.00	SD1074-2	18.00
MM1614	10.00	MRF892	35.50	PT4640	20.00	SD1074-4	28.00
MM1810	15.00	MRF894	46.00	PT4642	20.00	SD1074-5	28.00
MM1810	15.00	MRF901 3 Lead	1.00	PT5632	4.70	SD1076	18.50
MM1943	1.80	MRF901 4 Lead	2.00	PT5749	25.00	SD1077	4.00
MM2608	5.00	MRF902/2N6603JAN	15.00	PT6612	25.00	SD1077-4	4.00
MM3375A	17.10	MRF902B	18.40	PT6619	20.00	SD1077-6	4.00
MM4429	10.00	MRF904	2.30	PT6708	25.00	SD1078-6	24.00
MM8000	1.15	MRF905	2.55	PT6709	25.00	SD1080-7	7.50
MM8006	2.30	MRF911	2.50	PT6720	25.00	SD1080-8	6.00
MM8011	25.00	MRF965	2.55	PT8510	15.00	SD1080-9	3.00
MPSU31	1.01	MRF966	3.55	PT8524	25.00	SD1084	8.00
MRA2023-1.5	42.50	MRF1000MA	32.77	PT8609	25.00	SD1087	15.00
MRF134	10.50	MRF1004M	31.05	PT8633	25.00	SD1088	22.00
MRF136	16.00	MRF2001	41.74	PT8639	25.00	SD1088-8	22.00
MRF171	35.00	MRF2005	54.97	PT8659	25.00	SD1089-5	15.00
MRF208	11.50	MRF5176	24.00	PT8679	25.00	SD1090	15.00
MRF212	16.10	MRF8004	2.10	PT8708	20.00	SD1094	15.00
MRF221	10.00	MSC1720-12	225.00	PT8709	20.00	SD1095	15.00
MRF223	13.00	MSC1821-3	125.00	PT8727	29.00	SD1098-1	30.00
MRF224	13.50	MSC1821-10	225.00	PT8731	25.00	SD1100	5.00
MRF227	3.45	MSC2001	30.00	PT8742	19.10	SD1109	18.00
MRF230	2.00	MSC2010	93.00	PT8787	25.00	SD1115-2	7.50
MRF231	10.00	MSC2223-10	245.00	PT8828	25.00	SD1115-3	7.50
MRF232	12.07	MSC2302	POR	PT9700	25.00	SD1115-7	2.10
MRF237	3.15	MSC3000	35.00	PT9702	25.00	SD1116	5.00
MRF238	13.80	MSC3001	38.00	PT9783	16.50	SD1118	22.00
MRF239	17.25	MSC72002	POR	PT9784	32.70	SD1119	5.00
MRF245	35.65	MSC73001	POR	PT9790	56.00	SD1124	50.00
MRF247	31.00	MSC80064	35.00	PT31083	20.00	SD1132-1	15.00
MRF304	36.00	MSC80091	10.00	PT31962	20.00	SD1132-4	12.00
MRF306	50.00	MSC80099	3.00	PTX6680	20.00	SD1133	9.50
MRF313	11.15	MSC80593	POR	RE3754	25.00	SD1133-1	10.00
MRF314	29.21	MSC80758	POR	RE3789	25.00	SD1134-1	2.50
MRF315	28.86	MSC82001	33.00	RF35	16.00	SD1134-4	12.00
MRF316	55.43	MSC82014	33.00	RF85	17.50	SD1134-17	12.00
MRF317	63.94	MSC82020M	130.00	RF110	21.00	SD1135	10.25
MRF412	18.00	MSC82030	33.00	S50-12	23.80	SD1135-3	12.00
MRF420	20.12	MSC83001	40.00	S3006	15.00	SD1136	12.50
MRF421	25.00	MSC83003	82.00	S3007	10.00	SD1136-2	12.50
MRF422	38.00	MSC83005	70.00	S3031	22.00	SD1143-1	10.00
MRF427	17.25	MSC83026	POR	SCA3522	5.00	SD1143-3	17.00
MRF428	63.00	MSC83303	POR	SCA3523	5.00	SD1144	4.00
MRF433	12.07	MSC84900	60.00	SD345	5.00	SD1145-5	15.00
MRF449/A	12.65	MT4150	14.40	SD445	5.00	SD1146	15.00
MRF450/A	14.37	MT5126	25.00	SD1004	15.00	SD1147	15.00
MRF452/A	17.00	MT5596(2N)	99.00	SD1007	15.00	SD1188	10.00
MRF453/A	18.40	MT5768(2N)	95.00	SD1007-2	15.00	SD1189	24.00
MRF454/A	20.12	MT8762	25.00	SD1007-4	15.00	SD1200	1.50
MRF455/A	16.00	NE02136	2.00	SD1007-5	15.00	SD1201-2	15.00

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SD1202	$10.00	SD1304-8	$ 2.50	SD1451-2	$15.00	SRF1427	$50.00	SD1244H12	25.00	SD1410-8	21.00	SD1536-1	41.00	SRF2917	15.00
SD1212-8	4.95	SD1305	3.00	SD1452	20.00	SRF1431	40.00	SD1262	15.00	SD1413-1	18.00	SD1539H	100.00	SRF2918	15.00
SD1212-11	4.95	SD1307	3.00	SD1452-4	24.00	SRF1834	40.00	SD1263	15.00	SD1416	28.00	SD1542H1	170.00	SRF2919	15.00
SD1212-16	4.95	SD1308	3.00	SD1453H1	20.00	SRF2053-3	60.00	SD1263-1	15.00	SD1422-2	24.00	SD1544	26.00	SRF3071FF	50.00
SD1214-7	5.00	SD1311	1.00	SD1454-1	48.00	SRF2092	50.00	SD1272	10.95	SD1428	24.00	SD1545	33.00	SS4006	25.00
SD1214-11	5.00	SD1317	8.00	SD1477	35.00	SRF2147	22.00	SD1272-1	10.95	SD1428- 6084	12.00	SD1546H1	55.00	SS4152	15.00
SD1216	12.00	SD1319	2.50	SD1478	21.00	SRF2225	15.00	SD1272-2	10.95	SD1429-2	15.00	SD1561	79.00	TA7686	15.00
SD1219-4	15.00	SD1345-6	5.00	SD1480	53.00	SRF2264	25.00	SD1272-4	10.95	SD1429-3	14.90	SD1574-1	6.95	TA8559	15.00
SD1219-5	15.00	SD1347-1	1.00	SD1484	1.50	SRF2265	100.00	SD1278	13.75	SD1429-5	15.00	SD1575	6.95	TA8561	15.00
SD1219-8	15.00	SD1365-1	2.50	SD1484-5	1.50	SRF2281	5.00	SD1278-1	13.75	SD1430	12.00	SF6557	25.00	TA8562	15.00
SD1220	8.00	SD1365-5	2.50	SD1484-6	1.50	SRF2371	15.00	SD1278-5	13.75	SD1430-2	18.00	SK3048	5.00	TA8563	15.00
SD1220-1	9.50	SD1375	7.50	SD1484-7	1.50	SRF2347	50.00	SD1279-1	18.00	SD1434	28.00	SL501-59	15.00	TA8564	15.00
SD1220-9	8.00	SD1375-6	7.50	SD1488	22.85	SRF2356	30.00	SD1279-3	18.00	SD1434-5	28.00	SL501-173	15.00	TA8894	15.00
SD1222-8	16.00	SD1379	15.00	SD1488-1	28.00	SRF2370	16.00	SD1281-2	8.00	SD1434-9	28.00	SM7714	5.00	TIS189	3.55
SD1222-11	7.50	SD1380-1	1.00	SD1488-7	27.00	SRF2572	25.00	SD1283	10.00	SD1438	26.00	SRF112	15.00	TP312	2.50
SD1224-10	18.00	SD1380-3	1.00	SD1488-8	28.00	SRF2584	40.00	SD1283-2	10.60	SD1441	56.00	SRF395	50.00	TP1014	5.00
SD1225	18.00	SD1380-7	1.00	SD1499-1	36.00	SRF2597	25.00	SD1283-3	10.00	SD1442	15.00	SRF750	36.00	TP1028	15.00
SD1225-1	15.00	SD1405	21.00	SD1511H3	75.00	SRF2741	40.00	SD1283-4	10.00	SD1444	3.25	SRF769H	20.00	TRW3	5.00
SD1229-7	10.95	SD1408	25.00	SD1520-2	18.00	SRF2747	40.00	SD1289-1	15.00	SD1444-8	3.25	SRF887K3	2.50	TXVF2201/HP	450.00
SD1229-16	10.95	SD1409	18.00	SD1522-4	33.00	SRF2767H	40.00	SD1290-4	15.00	SD1444-9	3.25	SRF989K	15.00	V222-2	25.00
SD1232	4.00	SD1410	18.00	SD1528-1	24.00	SRF2821	25.00	SD1290-7	15.00	SD1446	4.03	SRF1005	50.00	V410IE	20.00
SD1240-8	15.00	SD1410-3	21.00	SD1528-3	34.00	SRF2822/2N6603	13.50	SD1300	1.25	SD1450-1	28.00	SRF1018	5.00	V415	5.00
SD1244-1	14.00	SD1410-6	21.00	SD1530-2	38.00	SRF2857	20.00	SD1301-7	3.00	SD1451	15.00	SRF1074	50.00		

Relays

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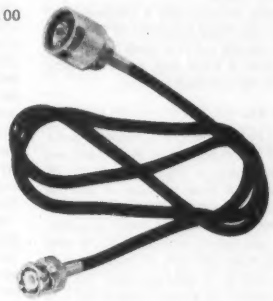

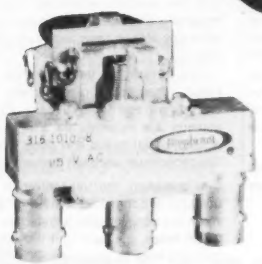

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REVIEW

THE HAL CWR6850

I am a closet RTTY enthusiast. Were you to ask, I would vehemently deny any interest in things digital, but at night, alone in my shack, I secretly tune in those weedle-deedles as my eyes grow glassy. I've even memorized the sound of CQ and RYRY.

So you can imagine my excitement when a traveling ham dropped by the office, driving an RV that sprouted antennas of various shapes and sizes.

"I've got a complete amateur station set up in there," said the visitor, "all bands, all modes, even RTTY. Wanna see it?"

My heart jumped. "Oh, sure, why not?" I replied coolly.

Inside the van was a complete ham setup, and those wonderful RTTY burbles were coming out of a small grey box on the table. A week later a Hal CWR6850 graced my operating position.

What it is

The Hal CWR6850 is a complete, portable RTTY/CW transceiver. It will send and receive Murray or ASCII at 45, 50, 57, 75, 110, and 300 baud, although an external modem is required for 300-baud operation. My unit came with three sets of specifications, and there is a disparity of CW rates among them. One lists 25- to 200-wpm receive and 15- to 250-wpm send. The second claims 3- to 40-wpm receive and 4- to 33-wpm send. In the third, it's 1- to 100-wpm receive and 4- to 33-wpm send. In practice, though, speeds above 60 wpm are pretty much all the same. The unit goes really slow (time for coffee between characters) to really fast (unintelligible buzzing). The CW-receive algorithm automatically tracks the incoming rate. Besides all of the normal Morse numbers and letters, the CWR6850 recognizes apostrophes, colons, parentheses, quotes, and several prosigns. Power requirements are 12 volts at 1.6 Amps.

Three RTTY shifts are provided: 170, 425, and 850 Hz. Either high (2125-Hz mark) or low (1275-Hz mark) tones may be selected. The center frequency for CW reception is 800 Hz.

On the front panel, push-button switches (there are 24) offer easy access to the most-used parameters such as speed, shift, and mode. A three-position toggle switch sets the unit into either manual send, manual receive, or automatic send and receive. Four slide potentiometers control input volume, monitor-output volume, CW transmit speed, and frequency fine-tuning. The green-phosphor CRT displays 20 lines of 32 characters per line on each of four pages.

The rear panel sports eighteen jacks and three controls. This may seem rather a large number of things to hook up, but a working RTTY station may be configured using only two connections: audio input and RTTY output. The plentitude of ports is the key to the CWR6850's flexibility. There is literally no limit to the varying combinations of options that may be chosen—from a simple two-wire system to a complex full-blown RTTY gargantua. The unit will interface with virtually any rig you can think of.

Operation

I was relieved to discover that the CWR6850 is not as difficult to use as I had first imagined. All of the switches and jacks were a bit intimidating, but in true ham fashion I set the unit up without cracking open the manual. In about ten minutes I had unpacked the box, hooked up an external 12-V-dc supply, run the appropriate (I hoped) cables to and from my ICOM IC-701, and said a short prayer. Surprise! It worked!

Now for the real fun. Tuning across the 20-meter RTTY subband, I was delighted to see the Mark and Space LEDs spring to life as I settled in on a strong CQ. I copied the call carefully on a scrap of paper and waited for the fellow to sign. There—now his call, my call...wait! Nothing's happening! I reluctantly dug around the shack looking for the instruction manual.

I ended up reading nearly the *entire* operation manual. So often a manufacturer produces a marvelous piece of equipment, spending who knows how many thousands of engineering hours, then hires a tenth-grader to write the technical manual for the thing. Or worse yet, the gear is imported and the tenth-grader translates the manual from Japanese. Hal's instructions were written by someone who a) knows everything about the product and b) writes English like a native. This is a *three-star* manual.

But I digress. The no-transmit problem was quickly resolved and I hit the bands. This time the lights blinked, the rig keyed, and I was in QSO! What a pleasure...the top half of the split-screen displayed incoming text while I composed my reply on the bottom half. Keyboard action is smooth, and it took some serious pounding to keep the transmit buffer full at 60 wpm. Occasionally, my mind would simply lock up, and I would stare blankly at the keys trying to find a letter. The CWR8850 would drop into receive and the other fellow would think I had turned things over. It made for some really interesting conversations.

Free Advice

The big question these days, is, "Should I buy a dedicated RTTY system or a computer with RTTY software?" Of course, there is no one-size-fits-all answer, but here is some advice to help you decide:

Consider to what extent you would like to be involved in amateur RTTY. A serious RTTY enthusiast will go for the dedicated system every time. Why? Well, a unit like the CWR6850 has been engineered for one use: RTTY. The hardware and software will consistently outperform a computer/interface combination, particularly when conditions are marginal. It's like using a UHF transverter on your HF rig: Sure, you can get on the air and make a few contacts, but it just isn't the same as using a station designed specifically for UHF. A computer will do the job, but after a while you are going to want more performance than the machine is prepared to give.

If you are a first-time RTTYer or plan only spotty RTTY operation, consider an inexpensive computer teamed with a simple interface. And I mean really inexpensive: You can assemble a working RTTY station for under $40 these days. Just remember the price tag when the gear copies only S9+40-dB signals!

Finally, decide how much you are willing to spend on your equipment. The Hal CWR6850 costs $750. A home-computer-based system that will match the CWR6850's performance will cost quite a bit more than that. And if you want to operate RTTY mobile or portable, a computer falls flat on its glass face. The CWR6850 is *designed* for just such activity. Remember—don't decide what to buy based on price alone. Weigh the unit's features and your requirements against your pocketbook.

Final Thoughts

Hal's CWR6850 does its job extremely well. It will copy just about everything you can hear, under conditions that send most add-on terminal units packing. Commands are simple and sensible, and the equipment has that "feel" of quality sadly lacking in much of today's gear. The manual is the best I've seen in a long time.

If you already are active on RTTY, consider the CWR6850 when it's time to upgrade your equipment. If you are unsure of which direction you want to go in assembling a RTTY station, take the time to write the folks at Hal. They are incredibly nice, and will help you decide just what it is you need to get on the air. Their address is *Hal Communications Corp., Box 365, Urbana IL 61801.*

Perry Donham KW1O
73 Staff

CES 510SA SMART PATCH

After a rather extended period of testing, I can say that the Smart Patch is quite a device. It performs very well and I think not only should it do quite nicely as a simplex patch, but also as a repeater's autopatch. A look at the features will show you what I mean.

For starters, the Smart Patch is microprocessor-controlled, making it an intelligent device. Normally a full-duplex device, you can disable this feature and set it up for half-duplex operation so it can be used in a repeater. I didn't have a chance to test this option since my repeater already has an autopatch, but I think that it should perform quite well in that situation. It did well on a simplex frequency, using a normal VHF two-meter FM mobile rig and an ICOM IC-22U in the shack.

Standard features on the Smart Patch also include single-digit (* or #, for example) or multi-digit control codes. And if the disconnect code is sensed from your mobile station, the CW ID built into this unit will sound to let you know that you're in range. Another feature is the ability to toll-restrict, and the timeout signal is a unique warning beep. The timeout can be enabled or disabled with the * sign. You can also select tone or rotary dialing, and a special detection circuit prevents the interruption of a call in progress. If someone tries to interrupt it, the Smart Patch will send a CW sequence. A touchpad-accessible code allows full access to the phone line for emergency calls.

The Smart Patch will act not only as a phone patch, but also as a reverse patch. A special CW sequence alerts you to the presence of a call, although the intelligence keeps the unit from transmitting if it senses someone is on frequency. It waits until the carrier drops before it transmits.

Since this unit is meant to operate in the full-duplex mode, transmit and receive sampling are built in. You can't detect the sampling as the unit swings from the telephone side of the conversation to the mobile-transceiver side of the conversation. The sampling rate, which is built into the firmware—programming—of this unit, is variable from about 150 ms to 1 second. It's fast enough that you can use this unit in the duplex mode. A VOX circuit monitors the received telephone audio and lengthens the sampling interval to minimize any losses from slow-switching radios.

This covers the basics of the Smart Patch. When you pop the covers of this unit you will see it is well made. The components are mounted on a high-quality printed circuit board and good construction techniques are used throughout.

In operation, the transceiver to which this unit is connected is held in receive. When the connect code is detected by the Smart Patch, the base unit transmits the dial tone back to your mobile rig. The carrier will be interrupted periodically as the base switches from receive to detect if the mobile unit is transmitting. If the mobile unit is transmitting during this sampling period, the base unit will lock into receive and hold the phone line.

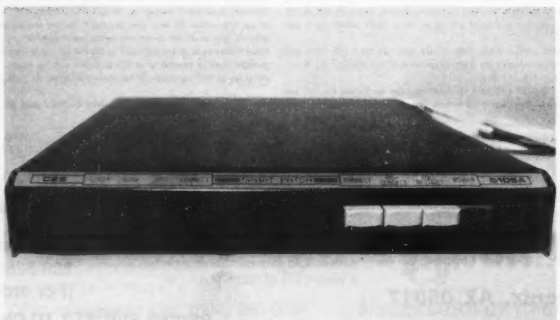
About the only thing for the mobile operator to remember during all of this is that after keying the transceiver he must pause until the next sampling period before dialing or speaking. However, this isn't a drawback since the sampling rate is at least every second or quicker on some radios.

When the mobile unit drops, the base will resume transmitting and sampling. And when the conversation is finished, the disconnect code is used to disconnect the patch.

That's all there is to it and I found during testing that the unit performs pretty smoothly.

For review purposes, we interfaced an ICOM IC-22A with the Smart Patch. The Smart Patch came equipped with a multicolored ribbon cable and connector for the ICOM's accessory socket. The instruction pamphlet clearly stated that only a few simple hookups were needed to make this unit work. However, we found this wasn't the case.

You must not only find a place to tap 12 V dc to power this unit, but you must also find a place to tap the push-to-talk line, ground, and mike audio. Most are readily available on the microphone connector. But the discriminator audio tap required



CES 510SA Smart Patch

several calls to CES before I could set it up. I eventually used the accessory terminal board for the connection and had to take a jumper from there to the accessory socket, as I did for the rest of the connections. One would think this could be done much more simply, as there are other units on the market which require connections to push-to-talk and transmit and receive audio, and that's all. It wasn't as easy a job as the instructions made it appear, but once the connections were made, it performed as advertised.

Programming this unit was handled via DIP switches on the circuit board and it was easy to handle.

The operational instructions for the CES Smart Patch were complete and easy to read. They assumed a degree of technical knowledge which was a welcomed change from other instruction manuals I have read recently, which seem to assume that all you know how to do is plug in the mike and power cables. In fact, some don't even assume you know that, but that's not the case with the CES Smart Patch.

Overall, the CES Smart Patch is a quality instrument. At $349, you will find it a good investment.

For more information, contact *Communications Electronics Specialties, Inc., PO Box 2930, Winter Park FL 32790; (305)-645-0474* or *(800)-327-9956.*

Marc Stern N1BLH
Framingham MA

HAMLOG—COMMODORE SOFTWARE

Computers do certain things very well. Storing and shuffling records around is one of them. Even though requirements for keeping a logbook were reduced and then all but eliminated in the ham shack, almost all amateurs keep a log of some kind.

Paper records are cumbersome and have a way fo getting lost, soiled, or faded. Computers in the ham shack promise to do away with some of these problems.

One of the many entries into the amateur-radio software field is HAMLOG. Their electronic logbook is available for the Commodore 64 and VIC-20 (with a minimum of 8K of expansion). HAMLOG is priced at $24.95. Both programs require a disk drive. HAMLOG comes with fourteen pages of documentation.

The program is contained on two disks. More accurately, the program is on one disk, with data stored on a second disk. The program disk auto-runs, eliminating the need to manually start the program. The same procedure also keeps you from having a look at the program itself. HAMLOG is copy protected allowing no easy way to back up your purchase. The program carries a 30-day warranty. After that you are on your own.

The data disk will allow you to create 700 entries or "log cards" as they are called. Additional data disks go for $5.00 each to registered owners only.

The overall appearance of HAMLOG is quite nice. It displays well on the screen and the prompts are clear. I especially liked the "keybeep" feature. When you are entering data, a pleasant beep sounds every time you press a key. Experts have proven that this feature reduces the number of input errors.

There are numerous ways of storing files using the Commodore computers. It would seem that just about everyone has his own thoughts on what is the best way to do this. HAMLOG is the first program of this type that I have seen that uses relative disk files.

For those of you new to computing, Commodore allows you to create three kinds of disk files. The most common is the program file. It is exactly what it sounds like, though with some word processors, text is stored as a program file. In general, a program file is used to store a computer program.

The next type of commonly used file is called a sequential file. Generally, such a file consists of text or numbers. It could be a letter to Aunt Mary or a DXCC countries list. The information is stored in a sequential fashion, each character following the one in front of it. Searching sequential files can take forever.

Finally, there are random files and relative files. Both make searching the disk for a particular piece of information much quicker. Relative files are structured into records. Within the records, the data is written into fields. This is the system used by HAMLOG. When using relative files, the programmer predetermines how large each record will be and how large each field will be within the record.

The versatility of such a filing system allows you to search by any of the fields within your log. You can select all the KH6 contacts for example, everyone named Jim, or perhaps all the contacts you made on your birthday. Such versatility can allow you to have "total recall" on the air so you can amaze all your friends!

How about other programs? How do they accomplish these things? Many of them, particularly programs designed for the 64, load all of the data into the internal memory of the computer. By doing this it isn't necessary to use the disk drive or tape cassette for anything but long-term storage. Particularly due to the relative slowness of the Commodore 1541 disk drive, this method can have its advantages.

One possible long-term negative effect of using the relative file method is that the disk drive stays active all the time you are searching or saving data. The 1541 is not the most durable piece of gear in the world. That's something you might want to consider when selecting your logging program.

Several features of HAMLOG deserve special mention. I liked the built-in QSL label generation routine. That will be a real advantage to the active contest operator or DXer.

Beam heading and actual distance information can be obtained for countries around the world.

Your log can be printed to a Commodore-compatible printer. In order for the printout to fit, you must use 9½-inch by 11-inch paper with the tractor-feed holes removed. I found that irritating since all of the paper I normally use is only 8½ inches wide.

The authors of HAMLOG spent a lot of time in creating a product that looks and operates well. I think a bit more explanation in the instructions of how the filing system works would be helpful, particularly to the novice user.

The instructions do not mention this, but it is possible to create your own data disks using one of several public-domain copy programs. You will want to do that before making entries or you will create a copy of an already full disk! It does take close to thirty minutes to create a data disk in this manner.

For more information, contact *HAMLOG, PO Box 308, Englewood OH 45322.*

Jim Grubbs K9EI
Springfield IL

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73 Magazine*, Peterborough NH 03458.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

I wonder how many of us got into RTTY as I did, with an overwhelming interest in tuning in to some of the RTTY news services. While I enjoyed my early ham RTTY experience, I know that what impressed the folks more than anything else was when I would tune in to this wire service or that bulletin and print out some current news item.

This came to mind the other day as I sat listening to the space shuttle in orbit. If you will pardon the tangent from RTTY, this is one aspect of our hobby that truly amazes me. Here in the Baltimore area we are blessed by being within VHF range of the Washington DC metropolitan area. As a service to the amateur-radio community, the Goddard Amateur Radio Club, located at the Goddard Space Flight Center in Greenbelt MD, retransmits shuttle communications for each flight.

You have no idea, if you have never done it, of the looks you can get by strolling through a store, hand-held on the hip, and having it blurt out, "Houston, this is *Discovery*!" I will say that it gives a new insight to the space missions, and I for one want to thank WA3NAN for the service. Although I can listen to the local link on 147.45 MHz, those of you not in the area can tune in as well on 3860, 7185, and 14,295 kHz. Transmission usually runs from launch to touchdown, so tune in to another goodie, only on amateur radio!

It's going to be hard to hide the schematic published this month (Fig. 1), so I guess I'd better get to that right now. I was strolling through my local Radio Shack the other day and I noticed a sale on a few chips of interest to RTTYers. This month, let's look at catalog number 276-2337, better known as an XR-2211 phase-locked-loop (PLL) demodulator. At five bucks (or less on sale) for the chip and a few dollars more for additional components, this certainly represents one of the most economical ways to get on RTTY.

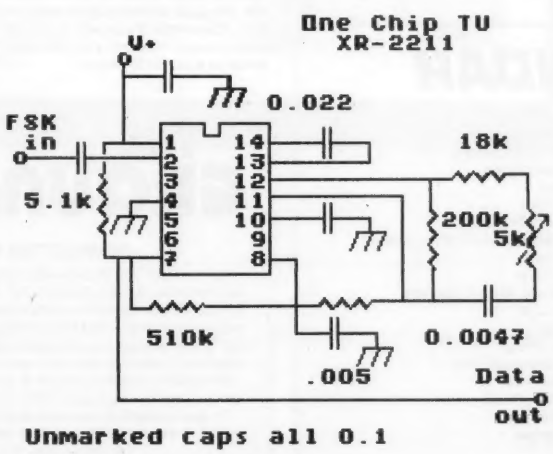


Fig. 1.

You can see that the audio signal from the receiver is coupled through a 0.1-uF capacitor to pin 2 of the XR-2211. The components shown in the schematic will set the PLL for the standard RTTY frequencies of 2025 Hz and 2225 Hz, and a 300-baud transmission rate. The center frequency of the PLL is determined by the 0.022-uF capacitor connected between pins 13 and 14 and by a 20k resistor formed by the combination of the 18k fixed and 5k variable resistors connected to pin 12. The bandwidth is defined by the 200k resistor bridging pins 12 and 11, and another filter is formed by the 0.005-uF capacitor and 100k resistor coming from pin 8. (The 100k resistor is not marked on the diagram.) This is only one scheme; additional information is packaged with the chip and is also available from any number of other sources.

In summary, this looks like today's version of a simple demodulator I built back in the late 1960s. That one used one tube and really did little more than detect and filter one of the two RTTY tones. I know it cost me more (in twenty-year-old dollars) than this one would cost and certainly did not perform as well. I hope this answers the question of where to find a simple starter TU.

Having said all that, I guess I would be remiss if I failed to acknowledge a rather

large packet of material received this month from Dan Szymanski K3SKE and Charles Miller K3ARN at Plantronics/Frederick Electronics Corporation in Frederick MD. They write, "After reading your 'RTTY Loop' column...I felt it is time you finally saw a good RTTY demodulator, not the computer interface PLL versions with no dynamic range or noise immunity to them." The material they sent along describes RTTY demodulators that would satisfy the most, and I mean the most, critical RTTYer. This is no surprise, as I have known of the excellent products produced by Frederick Electronics for many years. I would second the motion that, if you are looking for a professional quality unit (granted, at a professional price), you might drop them a note at 7630 Hayward Road, PO Box 502, Frederick MD 21701-0502. Be sure to drop our names in your note, okay?

Well, as I write this month's column I am still recovering from this year's giant Greater Baltimore Hamboree and Computerfest. Sponsored by the Baltimore Amateur Radio Club (which has had me as a member for too long to think about), this monster of an affair is traditionally held on the *rainiest* weekend in March. How they can predict the weather that far in the future is beyond me, but they haven't missed yet! Anyway, some photos of the goings-on are at the drugstore now, and if any of them are worth looking at, I will include them in the future. For the time being, let me just say that the proliferation of RTTY- and computer-related gear in our hobby continues to grow at an unprecedented rate. Everything from Model 15s to Model I's, on up to a packet-radio demonstration was there. Oh, before I forget, next year's 'fest is on April 6, 1986, moved a week later because of Easter. Maybe this will break the trend and be a sunny Sunday. See you there!

If I might get just a tad serious for a paragraph or so, I would like to address those of you who have felt a need to send certain other materials to me. Believe me, I am quite happy with my occupation, family, religion, where I live, and...well, you get the point. Please, please, try to contain your need to share what you may consider the good news, latest break, or whatever. I appreciate your mail, and look forward to deriving from it a sense for what you want to read about, but keep it at least somehow related to this column. Okay? Thanks.

Now, what I really have been enjoying are the varied, and I do mean varied, comments you all have been offering about the various RTTY programs for microcomputer systems. I really have received comments praising to the hilt the very same program that others of you would not touch with a ten-foot pole. I am taking some of your comments and forwarding them to the respective publishers for comments, with the submitting amateur's name deleted, of course. I hope that we will be able to get a handle on some of your complaints and perhaps glean a pearl or two of wisdom in the process. For those of you who have not yet acted, or who came in late, it's still not too late to send in information on the RTTY program you are using. We've run through all of the major microcomputer systems, so it's anybody's game now. Just tell me what system it's running on, the name of the program, the publisher would be nice, and any or all details you care to provide. What I especially am after is why you love it (if you do), hate it, or what you would like to see changed. Scribble it down on a postcard or QSL, save a few pennies postage, and send it to me at the above address.

Speaking of mail, those of you who have sent this or that note and enclosed a self-addressed, stamped envelope know that I do answer, albeit a tad slowly sometimes. Well, I think a new record has been set. A few of you have taken me up on the offer of reaching me through CompuServe and have received a reply within minutes of my receiving your E-Mail. Ah, the wonder of it all. If you want to take advantage of this communications marvel, I normally check the system every day or two and tend to hang around the CoCo SIG (GO COCO) or the Amateur Radio SIG (GO HOM-11). That all-important user number is 75036,2501. I will be looking for your comments.

Yes, there still are those of you who are asking about the summary of material from old columns. The list remains available at the above address for a self-addressed, stamped envelope. I try to update it every so often, so if you want the newest version, feel free to request it even if you have sent for one before. No problem.

I have a letter here from Leonard V. Sorg W0MNH, who has just gotten started in computers with a Tandy MC-10. This is the little wonder dubbed a "Micro-CoCo" when it was introduced, but instead of the 6809 CPU of the CoCo it uses a 6803, whose instruction set more closely resembles the 6800. At any rate, Leonard wants to put this computer onto RTTY and wonders how to do it. Well, I have seen nothing published on putting the MC-10 onto RTTY, and since Tandy has stopped making the thing, I suspect that we will see little more. I will nose around the SIG on CompuServe to see what turns up, but you may have to bite the bullet and try to convert some other program for your use. Leonard wants to try to do some of this in Basic, but I am afraid that interpreted Basic is just too slow for the task. I am sending that material which I have to him; stay tuned here for more, as it develops.

Another Motorola devotee is Lee Toman W3BIM in Quakertown PA. Lee is using a computer that runs a 6802 CPU and is interested in putting it on RTTY as well. Well, Lee, the 6800 code is directly translatable to 6802, as far as I know, so the elementary programs published here a few years back should serve you well. I am sending them along to you and hope you do well with the efforts. Be sure to let us all know, either with a note here or a call on the air.

Hey, Bud Johnson KA5UBH! I hope you can wade through the material I've sent you and that by now you have made some sense out of the Model 33 you have. As you may have realized, there is no "one standard" Model 33. Modifications were frequently done to adapt a particular unit to this or that service. I put the one I acquired in service after stripping it down and literally tracing the lines with an ohmmeter to figure them out. Book or no book, it's hard work. Perhaps someone in the Dallas area can touch bases with you, and with the materials I've sent you in hand and two (or more) heads butting together, you will get the thing working. Let me know what happens.

Looking in the hopper, I see plenty in the months ahead: photos from the hamfest, another circuit—this one for AFSK generation, some more letters, a rundown of the RTTY program hit parade, and all kinds of other goodies. Don't miss it—so many of you tell me that the first place you turn when you get your subscription issue is right here: "RTTY Loop."

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CANADA DAY CONTEST
Starts: 0000 UTC July 1
Ends: 2400 UTC July 1

Sponsored by the Canadian Amateur Radio Federation (CARF), the contest is open to all amateurs and everybody works everybody. Entry classes include single-operator all bands, single-operator single band, and multi-operator all bands. There are also separate single-operator QRP (5-W output) classes for all bands and single band.

Use all bands from 160 to 2 meters on CW and phone combined. All contacts with amateur stations are valid. Stations may be worked twice on each band, once on CW and once on phone. No crossmode contacts and no CW contacts in the phone bands are allowed.

EXCHANGE:

Signal report, consecutive serial number starting with 001, and province. Do not use a separate series of numbers on each band.

SCORING:

Score 10 points for each contact with Canada, 4 points for contacts with others. VE0 counts as Canada and one multiplier. Score 20 bonus points for each contact with any CARF official station using the suffix TCA or VCA. That means an official station counts 10 points plus 20 bonus points for a total of 30 points!

Note that an added bonus of 50 points will be awarded this year to any amateur that provides communications for Parks Canada from a national park during the contest. A 50-point bonus will also be awarded to any amateur who uses the special prefixes for the National Parks Centennial during the contest.

Multipliers are the number of Canadian provinces/territories worked on each band, on each mode (13 provinces/territories × 8 bands × 2 modes for a maximum of 208 possible multipliers). Contacts with stations outside Canada count for points but not multipliers.

Provinces and territories are: VO1/VO2, VE1-NB, VE1-NS, VE1-PEI, VE2, VE3, VE4, VE5, VE6, VE7, VE8, VE0, and VY1.

FREQUENCIES:

1810, 1840, 3525, 3770, 7025, 7070, 14025, 14150, 21025, 21250, 28025, 28500,

CALENDAR

Jul 1	CARF Canada Day Contest
Jul 13-14	IARU Radiosport Championship
Jul 20-22	CQ Worldwide VHF WPX Contest
Jul 27-29	County Hunters CW Contest
Aug 3-4	ARRL UHF Contest
Aug 17-18	New Jersey QSO Party
Aug 17-18	SARTG Worldwide RTTY Contest
Aug 19-25	Spec-Com North American UHF FSTV Contest
Sep 14-15	ARRL VHF QSO Party
Sep 14-16	Washington QSO Party
Sep 28-29	Late Summer QRP CW Activity Weekend
Oct 5-6	ARRL QSO Party—CW
Oct 12-13	Rio CW DX Contest
Oct 12-13	ARRL QSO Party—Phone
Oct 19-20	ARRL Simulated Emergency Test
Nov 2-3	ARRL Sweepstakes—CW
Nov 16-17	ARRL Sweepstakes—Phone
Dec 7-8	ARRL 160-Meter Contest
Dec 14-15	ARRL 10-Meter Contest

THE GROUNDWAVE

NEWSLETTER OF THE MONTH

July's winner, *The Groundwave*, comes to us from the Ottawa (Ontario) Amateur Radio Club (OARC). Gord VE3JMT, Ernie VE3ICP, Archie VE3NJY, and Kingsley VE3OFK pack as much information as possible into each monthly newsletter, including club news, regulatory actions, and feature articles on a variety of topics. A very important section acknowledges and welcomes visitors and new members of OARC, an item many clubs neglect.

We welcome *The Groundwave* to our list of award-winning publications, and congratulate the members of OARC on their superb effort.

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to 73, 80 Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

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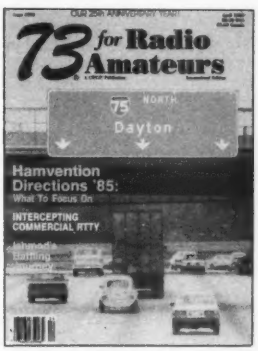

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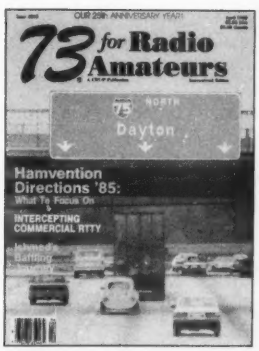

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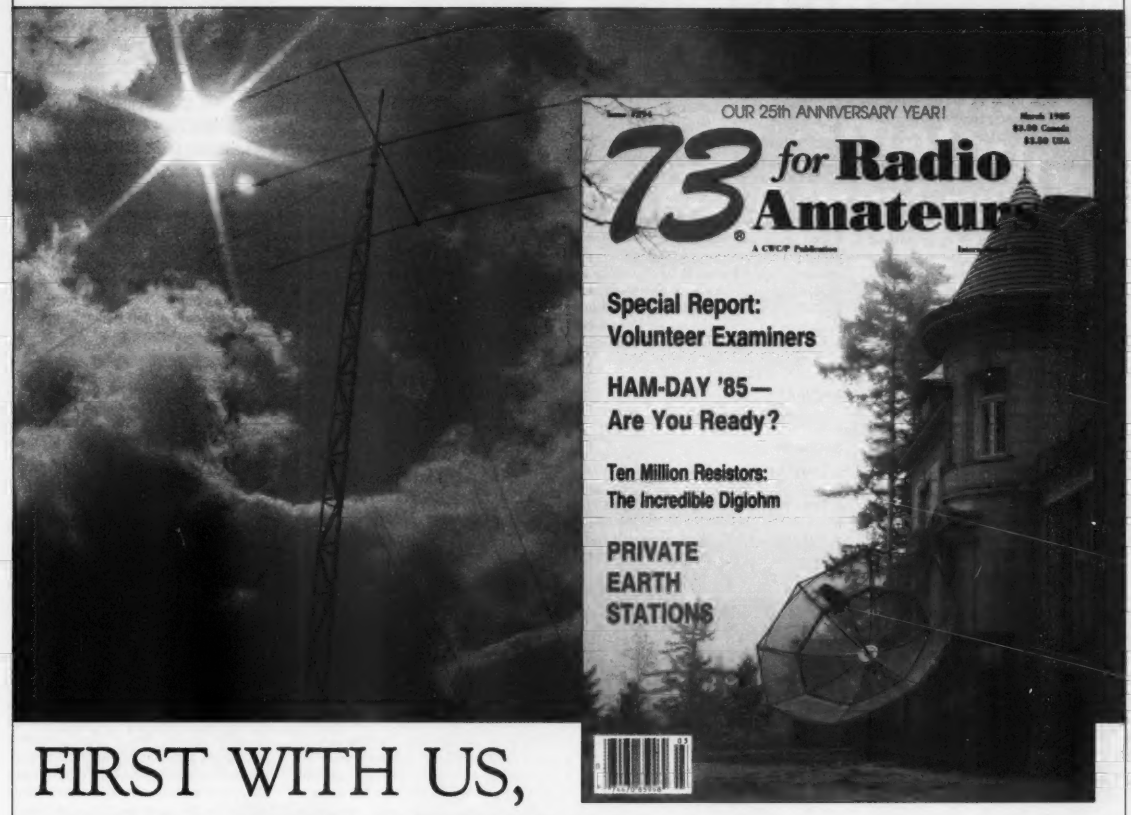

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50.040, 50.110, 144.090, 146.52. Suggest phone on the even hours (UTC), CW on the odd hours (UTC). Since this is a Canadian-sponsored contest, remember to stay within the legal frequencies for your country!

AWARDS:

Certificates will be awarded to the highest scorer in each category in each province/territory, US call area, and DX country. If scores are close, second- and third-place certificates will be awarded. Additionally, several trophies will be awarded to some top scorers, courtesy of sponsors.

ENTRIES:

A valid entry must contain log sheets, dupe sheets, a cover sheet showing claimed QSOs, QSO points, a list of multipliers, and a calculation of final claimed score. Cover sheets and multiplier checklists are available. Entries should be mailed within one month of the contest, with your comments to: CARF Contest, c/o N. Waaltho VE6VW, Box 1890, Morinville, Alberta, Canada T0G 1P0.

Results will be published in *TCA*, the Canadian amateur magazine. Nonsubscribers may include an SASE for a copy of the results.

IARU RADIOSPORT CHAMPIONSHIP
Starts: 0000 UTC July 13
Ends: 2400 UTC July 14

Note that these rules are from last year's contests as updated rules were not available in time for this column. Check the appropriate issue of *QST* for any last-minute changes.

This contest is open to all licensed amateurs worldwide. The object is to contact as many other amateurs in as many parts of the world as possible using 1.8 through 148 MHz. Single-operator stations must not operate more than 36 hours of the contest period. Operating categories include:

A) Single operator: phone-only, CW-only, and mixed-mode sections. One person performs all operating and logging functions. Use of spotting nets is prohibited. Off times must be 30 minutes minimum and single-operator stations are allowed only one transmitted signal at any given time.

B) Multi-operator: single transmitter, mixed mode only. Only one transmitted signal allowed at any given time and must remain on a band at least 10 minutes at a time. All operators must observe the limits of their operator's license at all times. Stations may be worked once per frequency band; crossmode, crossband, and repeater QSOs do not count.

EXCHANGE:

Signal report and ITU zone.

SCORING:

Count 1 point per QSO within your ITU zone, 3 points within your continent but different ITU zone, and five points with different continents. Multipliers are the number of ITU zones worked on each band. Final score is total number of QSO points multiplied by the sum of ITU zones worked on each band.

ENTRIES:

All entrants are encouraged to use forms available from IARU/ARRL headquarters. Send SASE or 1 IRC. Logs must indicate times in UTC, bands, calls, and complete exchange. Multipliers and off times should be clearly marked in the logs. Cross-check sheets are required if more than 500 QSOs total are made. Entries must be postmarked by mid-August; any entry received after mid-October may not be in time to be included in the printed results. Usual conditions of entry and disqualification apply. Entries should be addressed to ARRL, 225 Main Street, Newington CT 06111.

AWARDS:

A certificate will be awarded to the high-scoring CW-only, phone-only, mixed-mode, and multi-operator entrant in each ARRL section, each ITU zone, and each DXCC country. In addition, achievement-level awards will be issued to those making at least 250 QSOs or having a multiplier total of 50 or more. Additional awards may be made at the discretion of each country's IARU society.

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

CQ WORLDWIDE VHF WPX CONTEST
Starts: 0000 UTC July 20
Ends: 0000 UTC July 22

This is a brand-new event sponsored by *CQ* magazine but SCORE, the Society of Contest Operators and Radio Experimenters, of Denville NJ, is the administrative head of the contest committee. This contest is an international VHF/UHF competition where multipliers are prefixes and there are eight different levels of competition in each geographic area.

Details on SCORE and the contest ideas were presented in the February '85 issue of *CQ*, with possible updates to follow. Be sure to check *CQ* for any last-minute changes. If all goes well, the event is planned to be an annual event! Anyone interested in sponsoring awards can contact SCORE or *CQ* at the addresses listed below.

Classes of entry include: single-operator, single-band; single-operator, multiband; single-operator, single-band, low-power; single-operator, multiband, low-power; multi-operator, single-band; multi-operator, multiband; portable (with temporary power source), and FM-only. Low power is defined as 25 Watts PEP output or less.

Use all authorized amateur bands and frequencies from 6 meters through 23 cm (50, 70, 144, 220, 432, and 1296 MHz). All authorized modes are allowed for contest credit, with the single exception that repeater contacts cannot be allowed or counted for contest credit. Satellites are considered repeaters!

EXCHANGE:

Consecutive serial number and callsign.

SCORING:

Multipliers are prefixes worked per band. Score 1 point per QSO on 50, 70, or 144 MHz, 2 points per QSO on 220 and 432 MHz, 4 points per QSO on 1296 MHz. Work stations once per band, regardless of mode. Multiply total QSO points times total number of prefixes worked (the sum of the prefixes worked per band).

AWARDS:

For first-year participants, a commemorative certificate will be issued to *every* entrant to celebrate the first annual VHF WPX. Trophies to national top-scoring stations in each category. Certificates to top-scoring stations in each call area or country where special effort is demonstrated.

ENTRIES:

Contest entries should be mailed to SCORE, PO Box 1161, Denville NJ 07834, or to *CQ*, 76 North Broadway, Hicksville NY 11801.

CW COUNTY HUNTERS CONTEST
Starts: 0000 UTC July 27
Ends: 0200 UTC July 29

The CW County Hunters Net invites all amateurs to participate in this year's contest. All mobile and portable operation in less active counties is welcomed and encouraged. Stations may be worked once on each band, and again if the station has changed counties. Portable or mobile stations changing counties during the contest may repeat contacts for QSO points.

EXCHANGE:

QSO number, category (P for portable, M for mobile), RST, state/province/country, and US county. Stations on county lines give and receive only one QSO number, but each county is valid for a multiplier for the receiving station.

FREQUENCIES:

3575, 7055, 14065, 21065, 28065. On 20 and 40 meters, mobile and portable stations should call CQ or QRZ below the suggested frequencies. Fixed stations CQ or QRZ above the suggested frequencies.

SCORING:

QSOs with fixed stations are 1 point, QSOs with portable or mobile stations are 3 points. Multiply the sum of all QSO points times the number of US counties worked. Independent cities may be counted as any one of their adjoining counties in accordance with USACA rules. Mobiles and portables calculate their score on the basis of total contacts within a state for the state certificate and calculate their score on all operation if they operated from more than one state in competition for the High Portable or High Mobile Trophy.

AWARDS:

Certificates will be awarded in three categories:

P) Highest station in each state operating portable from a county which is not its normal point of operation, when total score exceeds 1,000 points.

F) Highest fixed or fixed-portable station in each state, province, and country when total score exceeds 1,000 points.

M) Highest station in each state operating mobile from 3 or more counties with a minimum of 10 QSOs in at least each of 3 counties.

Plaques will be awarded to the highest mobile, portable, and fixed stations in the USA who meet the above requirements for certificates. Additional awards will be issued where deemed appropriate.

ENTRIES:

Logs must show category, date/time in UTC, station worked, band, exchanges, QSO points, location, and claimed score. All entries with 100 or more QSOs *must include a check sheet of counties worked or be disqualified from receiving awards.* Enclose a large SASE if results are desired. Logs must be postmarked by September and sent to: CW County Hunters Net, c/o Jerry Burkhead N6QA, 7525 Baltic St., San Diego CA 92111.

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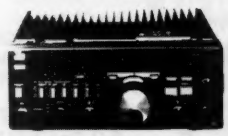

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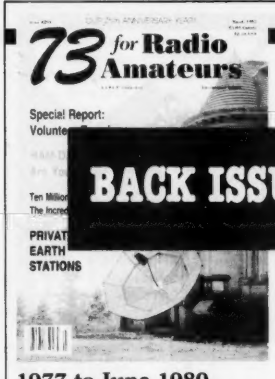

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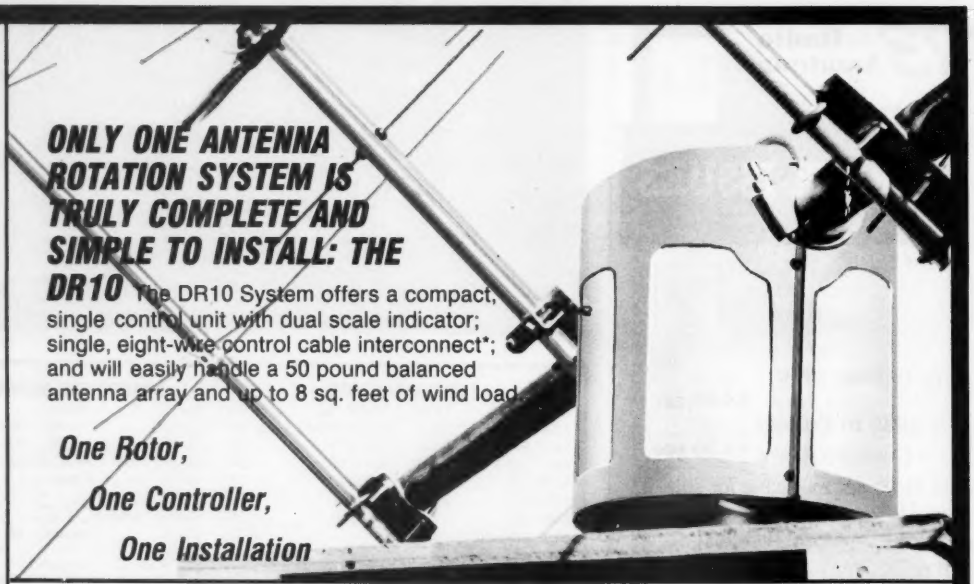

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LETTERS

HAM HIGH

I was impressed and pleased with the survey results in your May, 1985, issue. Allow me to add my voice to those in the amateur community who feel very positive about amateur radio.

I was licensed on May 29, 1985, through a Novice class at a local Civil Emergency Preparedness office. The instructors guided our class through elements 1(A), 2, and the code with endless patience and understanding. I owe both K1YNO and KA1FTL my thanks and respect.

An aspect of amateur radio not covered in depth in *The ARRL Handbook* that is extremely important is the special sense of belonging that erases barriers, makes instant friends of strangers, and broadens our understanding and enthusiasm for life.

As a new amateur still in the process of building a transceiver, I haven't had the pleasure of a QSO on the air. But I felt that sense of belonging in a special way during a visit with KA1HWY. I stopped at his house after noticing the antenna farm in the side yard. He and his wife had just returned from Florida and were very busy with unpacking. Although they had never met me, when I told them I was a Novice they welcomed me into their home. I spent an hour looking at equipment, listening to a QSO, and talking about antennas. KA1HWY told me he would be looking for me on the air and to keep in touch. I came away with a tremendous sense of pride for the Amateur Radio Service.

I know there are those who don't look at amateur radio as I do, but I feel they are selling themselves *and* the service short. It demands the best from each one of us and perhaps this is its greatest treasure.

Thanks for a great magazine!

Duncan (Scott) Cameron WA1MUY
Pemaquid ME

MISUSE AND ABUSE

I have a subject that I think should be brought up, and that is the misuse and abuse of the 10-meter band. I've only been licensed about 6 months, but I have noticed a dramatic increase in the number of intruders on this band. The intruders that I have noticed popping up seem to be car services and CBers.

I thought that 10 meters was allocated just to hams, not unlicensed persons! Even though I'm new, I have only come across a few other amateurs that care enough to monitor and take notes of such activity. It aggravates me even more when contests are going on and no one can copy anything! Has anyone else thought of taking action against these intruders? I guess not, or I would have read or heard something on the matter. Why do I sense that everyone is ignoring 10 meters? Even if the propagation isn't great most of the time, it's still a band that is allocated to us amateurs.

Let's all pay more attention to what goes on when this band isn't active. You will be very surprised at what goes on there! Let's not sit around and watch 10 meters turn into another Citizens Band. Remember, we might have to go through what we had to do to keep the 220-MHz band. I hope some of you give this some thought.

Billy Oggeri KA2VXY/AG
Queens NY

NEW BLOOD

As a relatively new subscriber to *73*, I guess it's time I sat down and said how much I enjoy the magazine. In a time when most hams, it seems, would rather buy the latest state-of-the-art equipment, it is great to see *73* packed with so many "how-to" ideas every month. This is the reason I buy *73*.

Looking back through my collection of magazines (dating back to the late forties) you can see ham radio drift slowly from the days when stations were either homebrew or at least kits, to the present, when it seems so many hams can't even solder properly. With articles in *73* on how to build your own RTTY and SSTV interfaces, I hope to see this trend reversed. With today's children being computer-literate in grade school, this may be one way that we can attract new blood into what would appear to be a dying breed.

Garth Carman
Edmonton, Alberta
Canada

ISHMOD EXPLAINED

Re: "Ishmod's Journal"

OK, you did it again, didn't you? Two times in a row? Come on, now! I am dying of curiosity—what in heck did ever happen to those guys? Do you ever think we will find out?

Patrick Chirington
Lakewood OH

Patrick—Spenser Whipple, Jr. was unfortunately out of town when we last called, but we do have a letter from him regarding Ishmod and the journal. Actually, we have half of the letter. The other half has mysteriously vanished. Spenser claims that he has discovered the

Continued on page 226

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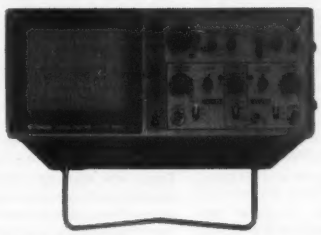

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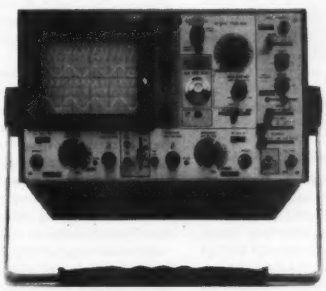

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73 INTERNATIONAL

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If you would like to contribute to your country's column, write to your country's correspondent or to 73 Magazine, *Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KW1O.*

AUSTRALIA

J. E. Joyce VK3YJ
44 Wren Street
Alton 3018
Victoria
Australia

Kirsti Jenkins-Smith VK9NL
PO Box 90
Norfolk Island
Australia, 2899

AMATEUR RADIO AN OFFSHOOT OF CB

This appears to be the belief at our local library. I recently decided to rejoin the library, with the view that I would be able to get background information for the columns for "*73* International."

Deciding to look up amateur radio, I found that the index card stated: "Amateur Radio—see Citizens Band Radio." "What?!" said I, in a voice loud enough to cause the lady librarian to leave her desk to ask, "May I help you Sir?" with the emphasis on "Sir"!!

After explaining my requirements, I got a quick now-you-see-it, now-you-don't tour of the electronics section. We don't exactly live out in the sticks, being only 8 miles from the center of Melbourne, with a well-appointed library that is supposed to be representative of modern trends—with computers for general use, etc., but even the computer file of amateur radio referred you back to Citizens Band Radio.

Vowing to come back when my embarrassment subsided, I bid her good-bye and retreated from the library with my tail between my legs—as the saying goes.

Gathering up enough courage, I again visited the local library the next weekend to find out what was available with regard to amateur radio. The following list proved somewhat of a letdown to me:

Modern Radio Servicing—Chirardi (1935)
Practical Communications—Nilson (1943)
Radio Engineering—Sandeman (1949)
Wireless for Beginners—Boltz (1964)
Teach Yourself Radio—Gibson (1968)
VHF Projects for Amateur & Experimenter—Wayne Green (1972)
Radio Amateurs' Handbook—1982 Edition.

As you can see by the above list, there's not much help to the budding amateur, apart from the latter couple of books.

There were quite a few books on servicing and operating procedure on CB, but the main information was of pre-1970 vintage, showing the lack of promotion we in the amateur service give in our local area.

I wonder what your local library has in the way of information on amateur radio?

STOLEN EQUIPMENT

There has been, of late, an upsurge in the theft of amateur gear in VK, with some amateurs getting their whole shack cleaned out. One of the unlucky losses I have heard about was by the chap who, having saved up for 18 months to buy a new transceiver, traveled down from the country to the city to buy an FT-101ZD at a discounted price.

After buying the set and placing it in his car, he decided to buy a packet of cigarettes from the shop next door. Only going to be away 2 minutes at the most, he failed to lock the car. You guessed it; no rig on his return. When last heard, he was having "in depth discussions" with his insurance company, re a replacement.

To try to alleviate the problem of tracing stolen equipment, the Federal Branch of the WIA has now started keeping a list of all amateur-radio gear stolen, Australia-wide, with the view that there might be some organized interstate trafficking in stolen equipment. This centralized listing also will make it easier to trace the original owners. The WIA's nationally-distributed magazine, *Amateur Radio*, is also going to publish a monthly list of all amateur gear stolen, with serial number listings and easily-distinguishable markings.

THIRD-PARTY TRAFFIC

Third-party traffic agreements are being finalized by the Department of Communications with Venezuela, Honduras, and Liberia. This will bring to five the number of countries with which Australian radio amateurs can directly exchange third-party messages. America and Canada were the first to reach third-party agreements with Australia.

Following requests from the WIA, further negotiations are continuing with another 30 countries to obtain further such agreements.

AUSTRALIAN TRAFFIC NETWORK

International third-party traffic exchanges between ATN and the National Traffic System of the US and Canada have taken place over the International Assistance and Traffic Network at 1130 UTC on 14.303 MHz daily, over the four-year period, 1981–1984. Due to poor propagation over a three-month period, two new networks are now carrying this traffic—effective January of this year.

The international Morse-code section of the ATN is daily at 0700 UTC on 7.037 MHz ± QRM; the international phone section of the ATN is daily except Sundays, 0800 UTC between 7.225 and 7.300 MHz.

Several operators in Canada and the US pass traffic using RTTY, AMTOR, FEC, or packet. If you wish more information, check into the national phone section of the ATN daily at 1030 UTC, 3.570 MHz ± QRM.

VK9X—CHRISTMAS ISLAND INFO

Many people keep asking on air if there is any activity from VK9X. Well, as of this writing there are five amateurs on the island. They are Craig VK9XW, Ron VK9XA, Charles VK9AB (limited license, meaning 6 meters and above), Dane VK9XD, and Ron VK9XJ. There also has been Lance VK9XG checking into the 14.220 net at 0600 UTC on odd occasions. Steve VK9XB had a two-week DXpedition to Christmas Island during late March/early April. His QSL info is via home call VK6IR.

Although the signals are down at the present time due to poor antenna systems and band conditions, the near future should see better antennas erected and more operations from this much-wanted DX location.

de VK3YJ

NORFOLK ISLAND

Norfolk Island has been variously described as "only fit for angels and eagles," "a thousand miles from nowhere," and similar terms to indicate its isolation and inaccessibility.

All this was true in the old days—also referred to as the "days of blood." Norfolk Island was then a maximum security penal colony. The prisoners being held here were those considered too dangerous, too unruly, too villainous to be held in mainland Australia. This was the end of the line, one step away from the gallows. From here there was no escape.

This era of Norfolk Island's history is full of tales of mutiny, revolt, murder, revenge, executions, lashings, and curses. Especially the curses. On the south side of the island lies Kingston, with the prison ruins and officers' quarters, military barracks and stores still lining the road now known as Quality Row. Even today what is left of the prison compounds mutely echos the depraved officers' shouts and the prisoners' cries and curses.

Some of the buildings from this era are still in use. The Commissariat's Store has become All Saints Church and the Military Barracks house the Administration offices. Several of the officers' quarters are now in use as private homes.

Kingston abounds with ghost stories. People who value their sanity do not, for instance, work overtime in the Administration offices. White faces have been "seen" staring out of windows on many occasions. There is the sound of footsteps, a chair creaks as if someone just sat down, doors quietly open and shut... there is the creeping sensation of the unknown watching you.

This part of the island has not changed over the years. No shops or other commercial development has been allowed. The area is a big outdoor museum with authentic atmosphere among the stone walls. We walk on convict-built roads, sit on the convict-built seawall looking out over the endless blue empty ocean where only the surf breaking on the coral reef relieves the monotony.

Ships seldom lay their courses close to Norfolk Island. In that respect, it is still too far away from anywhere. But a small freighter calls in every six weeks or so, bringing supplies. The island has no harbor, so the freighter lies at anchor and is unloaded by lighters. Time is of the essence when "the ship's in." If the seas become rough, unloading has to be abandoned.

Such was the only communication Norfolk Island enjoyed with the outside world until 1902 when the Pacific Cable Board's station was opened. Norfolk became an important link in the Pacific cable system. From Vancouver, the cable came via Fanning Island and Fiji to Norfolk where it divided, one arm extending to Queensland, Australia, and the other to Auckland, New Zealand. The Island thus had a telegraph link to the outside world.

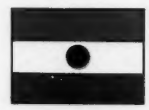
With modern technology came the closing of this station, at the end of 1962, to be replaced by a radio link. To begin with, this also was strictly for telegrams, but as time went on the radio link developed to serve overseas telephone calls as well—more often matters of sheer frustration than anything else.

Angels and eagles had become a thing of the past. The airstrip built during World War II effectively opened up Norfolk Island to more earthbound creatures like tourists and new settlers. With the influx of people from 1960s and onwards, proper communication facilities became an important issue. But it was not until 1984 that things changed for the better. The huge ANZCAN cable now connecting Australia, New Zealand, and Canada also takes in Norfolk Island. The "cable station" is again a reality.

We now enjoy direct-dialing overseas telephone, telex, and facsimile facilities. This year could see the introduction of satellite TV. Plans for a satellite which has Norfolk Island in its footprint are set down for August.

And while all this 1985 technology and tourist-related hustle and bustle takes place in the interior of the island, Kingston rests calmly, a solemn monument to Norfolk Island's "days of blood," enveloped in a mist of salty spray blowing inshore from the breaking surf.

de VK9NL



INDIA

Miss R. Subha
3 Thiru-Vi-Ka Road
Post Box 725
Madras 600 006
India

The import of several hundred Yaesu, Kenwood, and ICOM hand-helds into this country has highlighted the need for repeaters in the large cities—Bombay, New Delhi, Madras, and Calcutta—where the concrete jungle reduces the range of the hand-helds to less than a mile. Most of these hand-helds are either hibernating or are being used as base stations with rooftop ground-plane antennas. Some are used in automobile, bicycle, and walking mobile modes.

The owners of these hand-helds now see clearly the need for a repeater on one of the tall buildings. Tall buildings are aplenty—but where are the repeaters? Most of the local societies have discussed this issue at length and members have pledged the equivalent of ten to twenty dollars (US) each for the purchase of a repeater, but the discussions have always ended upon how to get an affordable repeater.

There is one logical source for Indian hams: Look to the West for the gold mine of used and retired repeaters. The move towards microprocessor-controlled repeaters in the US obviously results in a number of old, simple, common-access repeaters being retired. What happens to these repeaters? We asked a number of visiting US hams, most recently, Bill Eccles KE4VT, and the answer was always, "I have to ask my local repeater group."

We now bring this question direct to the readers of *73*. If you have a used 2-meter repeater to give away or to sell, please consider offering it to The Federation of Amateur Radio Societies of India, 3 Thiru-Vi-Ka Road, Post Box 725, Madras 600 006, India. The FARSI President, M. V. Chauhan VU2MV, will coordinate the import

and deployment of any repeaters that may be offered.

If you are responding, please send brief specs and mention the price. The buyer will have to apply to the government of India for a waiver of customs duty based upon this offer. Please be clear about what is included—especially the duplexer. If it can be shipped by surface mail, will you please include an estimate of the mailing costs? An estimate of the air freight may be included as an option. Thank you!

JAPAN

Roy Waite W9PQN
Tomigaya Grand-301, 2-19-5 Tomigaya
Shibuya-Ku
Tokyo 151
Japan

VISITING JAPAN?

If you are a ham and are contemplating a visit to Japan, there is a ham-radio club that you should know about. It is called TIARA, or Tokyo International Amateur Radio Association. We meet on the last Friday of each month at St. Alban's Church here in Tokyo. Let me tell you briefly about TIARA, what we do, have done, and hope to do in the future.

TIARA was founded in June, 1971, by two English and two American hams; I was one of the Americans. Prior to that time, the only foreign-affiliated amateur-radio club in Japan (to my knowledge) was FEARL, or Far East Amateur Radio League, which is a military-affiliated organization. Nothing wrong with that, of course, but we non-military types living in Tokyo do not have easy access to the military bases, which are located at some distance outside of town. In any event, we put our ham heads together and decided to form a club for foreigners, by foreigners, of foreigners. (Not an original thought by any means.)

But what about the Japanese hams? The pros and cons of that were kicked around. One man worried that since the ham population in Tokyo is so huge we'd soon be overrun if we opened our doors to Japanese hams, and the club would lose its "foreign" flavor; we would have defeated the original purpose. Others reasoned that ham radio is not an exclusive fraternity and its true spirit is best expressed by borrowing a cliche: everyone, regardless of race, nationality, color, sex, creed...!

So we began on that note, and in fact were not overrun by Japanese hams; instead, we found many new fine Japanese friends, many of whom are still staunch TIARA members to this day. Of course, we found the other kind, too, including some Americans whom we felt were so obnoxious that we swiftly announced that our membership rolls were temporarily closed when they approached us to join. (Forgive us, Lord!)

At present, the president of TIARA is Joe Speroni AH0A/JH1ZDJ. Under Joe's guidance, TIARA has greatly expanded the number of members, installed a repeater station in one of the highest spots in Tokyo, and has done a lot of work with the Japanese Ministry of Telecommunications and Post to help get the reciprocal agreement put into effect (which, so far, has not been completed).

Some of our accomplishments:

- We helped get a group of young men on the air from a hospital for muscular dystrophy patients, arranging for manufacturers to donate equipment, and helping to put the antennas up.
- We helped get the Maryknoll Sisters on the air, as well.
- Bill Stenson NA2Y/JR1YGP, one of our vice-presidents, established a non-profit-making school for budding hams, and has graduated many, many new hams and brought them into our ranks.
- We publish a monthly newsletter called simply *TIARA Bulletin*, edited by Ms. Pat Degeest NJ7R.
- We have an annual Field Day here on the first weekend in August.
- Last year we had our own booth at the Hamfest (a mini-Dayton Hamfest) in August, and are planning the same this year.

For the future, we are looking forward to reciprocal operation instead of club-station operation as we have at present. Also planned are bigger and better Field Days.

If you're going to be in Tokyo either as a resident or traveler, drop us a line at TIARA, PO Box 119, Akasaka, Tokyo 107-91, Japan. Or, after you get here, call our secretary, Keith Wilkinson ZL2BJR, whose telephone number is 0462-28-5367. We'd be delighted to have you join us either as a new member or as a visitor.

LIBERIA

Brother Donard Steffes, C.S.C.
EL2AL/WB8HFY
Brothers of the Holy Cross
St. Patrick High School
PO Box 1005
Monrovia
Republic of Liberia

AMATEUR RADIO IN LIBERIA

Liberia has a new repeater!

Getting a new repeater would not make headlines in many countries but it is real headline news here. For years, and it is probably more than a dozen, there has been one repeater in Liberia. It boasts of a tower on top of a mountain which rises majestically to a height of at least twelve hundred feet. It was set up and maintained by a small group of German amateurs who found themselves on the staff of the Bong Mines Iron Ore Company. The company was named after Bong County, Liberia, in which it is located.

The Bong Mines area is located some forty miles out of Monrovia. With reasonable equipment and a good antenna, the repeater serves the Monrovia community very well, and with better equipment it can reach some of the outlying areas. Dr. Munson EL5G, who has written for this column on at least two occasions, was able to access the Bong Mines repeater from a distance of more than a hundred miles. He built a 14-element yagi and drove it at about forty Watts. On good days, Dr. Munson was able to communicate with Monrovia Q5 from his QTH almost at the border of Sierra Leone.

In 1977, Walcott Benjamin EL2BA, who was president of the Liberia Radio Amateur Association at the time, went to a meeting of the International Amateur Radio Union. He went as a representative of the local association. In his conversations with the delegates from the German Amateur Radio Society, he suggested that they consider the possibility of contributing a two-meter repeater to Liberia. Correspondence has been carried on during these intervening years. There were many difficulties to be worked out, but the effort went on on both sides and now, in 1985, we have the repeater. It is new. It is installed. And...it works.

At the present time the arrangement is temporary. It has an excellent location and a very good antenna. It responds to a one-Watt HT from anywhere in the greater-Monrovia area. It is battery powered with a voltage-controlled charger keeping the batteries at full charge. The location will not be changed but it will have to be given a new frequency.

The plan is to make this repeater "talk" to the Bong Mines repeater and in turn to make it "listen" to the Bong Mines repeater and then tell us what it is saying. Fortunately, we have a number of amateurs in our association who are able to handle technical problems of this nature. Fortunately, also, we have another little repeater, about ten Watts, which can be used as a link between the other two.

The Monrovia repeater will transmit at 145.050 and receive at 145.650. It will be connected by wire to the little repeater which will transmit to Bong Mines at 145.100 and receive signals from there at 145.700, which will then be transmitted to the Monrovia area at 145.050. In the meantime, the Bong Mines repeater operates as it always has, receiving at 145.100 and transmitting at 145.700. When all this is working according to the projected plan, we will have HT communication all over this part of Liberia.

The situation in Liberia is somewhat unique. We really need to have everyone on the same repeater in order to achieve the kind of communication that we need. We never have the problem of the repeater being crowded. In the past, it has been next to impossible to contact anyone during the working day, and even at other times one could not contact another amateur unless the other person happened to be at home. With this new HT capability it will be a simple matter to carry the little radio along and be available at the other times during the day.

NEW ZEALAND

D. J. (Des) Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

I have been reading with interest through *73* editorials and columns about the issues on the "no-code license" proposals and their subsequent demise on ARRL's recommendation. It causes me and other ZLs to chuckle! Here in ZL-land we have had a no-code license since 1962. In fact, soon some of the original "T" call hams (as we colloquially term our Grade III amateurs because originally their callsigns were prefixed by the letter "T" after the District ID, e.g., ZL2TDB) will become eligible for membership in the Old Timers Club (25 years an amateur). A proportion of these Grade III amateurs are interested only in VHF/UHF/SHF experimentation, development, and operation. They have no desire to progress to the higher grades of license. There are also some who don't wish to learn Morse code, a requirement to progress to the higher grades of license.

To obtain an Amateur Operators Certificate, Grade III (no code), the candidate is required to pass an examination containing written papers on the elementary principles of electricity, radio communication techniques, the adjustment of a typical amateur station, and the Radio Regulations as they are applicable to the Amateur Service. The Grade III license entitles the amateur to operate 27.12 MHz, 51.00–53.00 MHz, and all bands 144 MHz and above.

To progress in the hobby, the amateur must pass a Morse-code test, sending and receiving at twelve words per minute for three minutes. A pass in this test entitles the amateur to the Grade II certificate, and operation on these additional bands: 1800–1950 kHz, 3500–3900 kHz, 28.0–29.7 MHz, and 50.00–50.15 MHz.

To obtain a Grade I license, the Grade II amateur must have operated for at least one year in that grade and had not less than 50 contacts on frequencies below 50 MHz. In addition to this qualification, the amateur must show by a further Morse test that he/she is still able to send and receive at 12 wpm.

The no-code license in New Zealand has not had any detrimental effect on the hobby; in fact, in the 22 years we have had the Grade III licenses, the numbers have grown to include some very dedicated and technically-proficient VHF/UHF/SHF members who are the leaders in the ZL VHF, etc., developments, as the next paragraph indicates. So go to it, amateurs in the US, support Wayne and the others who have plugged for the no-code license; it is a way of harmlessly introducing more to the hobby.

THE AUCKLAND-WELLINGTON LINK SYSTEM

For the past two years, interested amateurs have been investigating the possibility of a VHF/UHF link system between the two main cities of the North Island of ZL, Auckland and Wellington, a distance of about 500 km, line of sight. The system will be introduced very soon. The link will consist of UHF broadband system with an intermediate repeater site at about the halfway point sited on Mt. Egmont on the west coast of North Island. The link will provide up to twelve 3.4-kHz-wide voice-frequency channels for use as simplex and repeater links, initially between Auckland and Wellington but later to be extended as the need arises to other North Island areas and South Island.

Why do we in ZL want the system? The reason for, and the uses to which it may ultimately be put, are many. The technical challenge presented by the concept of repeater linking is exciting, and will extend the knowledge and expertise of those involved. As the link expands, then too will other NZART branches involve interested technicians to extend their expertise and knowledge accordingly.

The applications are many. The first phase of the system will see two UHF repeaters, one in Auckland and one in Wellington, linked on a permanent basis. This first application will, it is hoped, stimulate further interest in UHF generally and increase the activity on the 70-cm band. Extensions of the link to other UHF repeaters could see a network of linked UHF repeaters around the country, providing reliable 24-hour communications. This has obvious applications for AREC (Radio Emergency Communications) and Civil Defense emergency communication as a supplement to the existing HF links. If the level of activity increases as a result of this facility, a more complex linking/switching system may have to be introduced.

Other applications include a monthly Official Broadcast, special applications such as packet radio, HF DX information, AMSAT information, and a host of others, provided one has the time to look for them. The interest in AMSAT has in-

George England ZL2LT in his wheelchair, shortly before his death.

L to R, Jos ZL2BAO, Jack Carrell ZL2AWZ, Flo KU7F, and Irv KU7E—when Flo and Irv were visiting Jack in February, 1984.

creased to the point where a weekly AMSAT news and net is necessary to keep the growing number of amateur satellite users suitably informed.

In order to cater to the interests of those amateurs who will never want to operate on the bands above 2m, an addition already planned is a scanning-type transceiver at both ends of the link, with one channel being used to tie the two transceivers together. Normal operation of the transceivers would be in the scan mode, listening to all the local 2m repeaters in range of the site. To use the link, an amateur would generate a specific tone sequence either on a frequency directly into the scanning transceiver or via his local repeater, the output of which would be heard by the scanner.

This would be recognized by the scanning receiver as an access code and it would respond with a short tone burst in acknowledgement. On receipt of the acknowledge tone, the amateur could then transmit a further series of command tones which would be passed along the link to the scanning transceiver at the other end. These tones would cause the scanning transceiver to switch to the remote repeater selected so the originating amateur could hold a QSO of say three minutes duration after which the link would time out, releasing the equipment. The Wellington-Mt. Egmont link will be 1259.15 MHz/1299.15 MHz and the Mt. Egmont-Auckland link, 1259.5MHz/1299.5 MHz, both ends being accessed on 70 cm.

SILENT KEYS

Recently, two very well known amateurs from your correspondent's area joined the ranks of the Silent Keys, and as they both were well known on the amateur bands in ZL and overseas, I felt each warranted a paragraph or two in this column.

Jack Carrell ZL2AWZ became a Silent Key in January this year. Jack was known to his many amateur friends overseas for his willingness to help where needed and his hospitality; he hosted many overseas amateur visitors from W, VE, VK, JA, and many other countries in his home at Hastings. (See photo.)

Jack was for many years one of the main MCs of the New Zealand County Hunters Net held daily on the HF frequencies, and was instrumental in obtaining their NZ Counties Award for many overseas amateurs. First licensed in October, 1957, as ZL2AWZ, Jack obtained his high-frequency permit in March, 1959. He was associated with the Scout movement as a JOTA station on many occasions, and was a member of the Masonic lodge. He was awarded a plaque by the County Hunters in 1982 in recognition of his services to the county hunters of North America. Jack's son, Mark, a recent visitor to California after attending the Police Olympics, hopes to sit and pass the amateur examination this year and then to apply for his late father's callsign.

George England ZL2LT, better known as 2 London Tokyo, aged 36 years, also became a Silent Key in January this year (see photo). George was probably one of the most physically-handicapped amateurs in the world. He suffered from muscular dystrophy from birth which got progressively worse as he matured. He was completely paralyzed from the shoulders down, being able only to move his head. He was confined to a wheelchair, and since 1972 was a resident at the Pukeora Home for the disabled at Waipukurau.

George was licensed by special permit for RT only as a Grade II operator in June, 1966, and was granted HF privileges in 1968. He operated his wheelchair, amateur rigs, and an electric typewriter with a stick attached to a headband centered on his forehead. He kept his log on the electric typewriter, in duplicate, on teleprinter paper; one copy he kept, the other was sent to his mother and QSL Manager, Vi ZL2BGK. He was an intelligent, witty ham, who liked the ladies, his beer, and amateur radio. He had a phenomenal memory and a great sense of humor, and was always ready to pass a QTC for anyone at anytime. His voice will be sadly missed from the HF and VHF bands. George would be well known to many overseas amateurs, as he was very active on the HF bands from 1968 to 1972 when he lived in Wellington, and since 1972 when he moved to Waipukurau.

TIDBIT

Have you ever traveled 10,000 miles to attend a Field Day Contest? Don Fisher VE3ESE/ZL9AHH from Toronto, Ontario, Canada did just that in February this year. Don was vacationing in New Zealand with his wife, and he arranged his itinerary so that he was visiting Lee ZL2AL in Hastings over the weekend that the ZL Field Day Contest was held. Don joined the Napier Branch team on the banks of the Tutaekuri River and, in his words "had a ball." He helped the Branch 25 team to victory in the ZL2 District contest, and they expect to be about 3rd overall in ZL. After the Field Day weekend was over, Don and his wife continued their camper-van holiday towards Auckland and his departure home to Toronto.

Don is involved in Field Day organizing in his home QTH, so his help was invaluable during the weekend. He had his wife take a photo of the Branch toilet (*mercifully not shown—Eds.*) to show his Toronto ham friends how ZL Field Days provide "home comfort."

PORTUGAL

Luis Miguel de Sousa CT4UE
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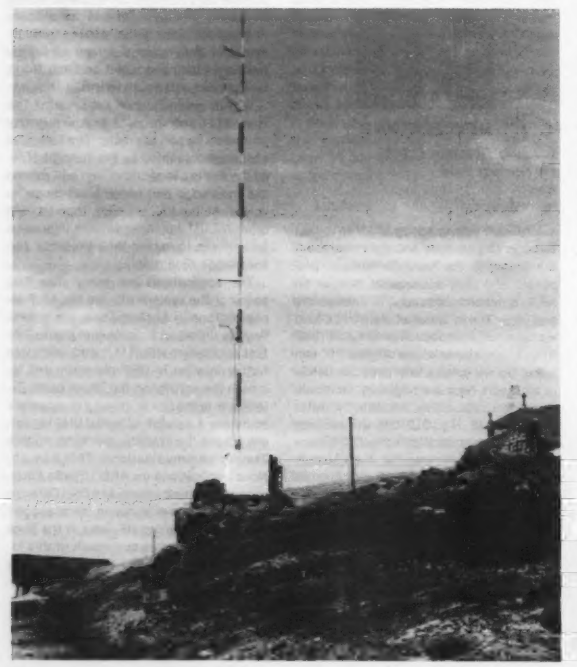
S. Joao do Estoril 2765
Portugal

Here we go to introduce you to another ham association and its activities along the year: ARN (Associacao de Radioamadores do Nordeste). This club was founded on the 27th of January, 1984.

Situated in a town known as Braganca, it has a lot of enthusiasts ready for hard work. At this time of writing, it has 60 reg-



VHF repeater R3, 100 feet high, on Nogueira Hill, near Braganca. (Photo by ARN)

Inaugural day for the repeater, with some EA operators also there. (Photo by ARN)

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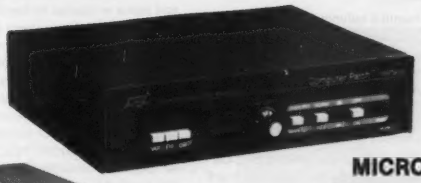

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The new AEA model MP-1 Micropatch represents the best features and performance available for under $140.00. Featuring true dual-channel filtering of Mark and Space tones with an AM detector and Automatic Threshold Correction (ATC) circuit, the MP-1 is in a totally different performance class than competitive units that often have only a single channel filter or no filtering at all.

The MP-1 also offers a high performance CW capability. With respect to the CP-1, overall performance is nearly as good; but the CP-1 offers a few more advanced features such as variable shift tuning, RS-232 option, and a more advanced tuning indicator.

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The new CP-100 Computer Patch offers all the following exciting features in addition to the CP-1 features:

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istered members, most of them licensed hams with their own callsigns.

For those preparing a tour next summer, Braganca is right in the north, in the province of Tras-os-Montes (over the mountains). The name of this province reflects the mountainous character of the region. It is adjacent to the Spanish border. This remote northeast corner of Portugal was the home of Portugal's last royal house, the House of Braganca.

Currently, the ARN is preparing rules for a permanent award, and as soon as we have more details on this we will print them at once. (Award hunters, don't give up!)

Up there, just on the top of Nogueira Hill, there is a VHF repeater (R3), a 100-foot tower, and all the other components that we usually have in a good repeater. The station itself is situated about 1,350 meters from sea level.

On inaugural day, June of 1984, a lunch took place to celebrate the event, and among others, several Spanish hams were in attendance (a few EA operators do belong to ARN).

ARN projects for the future include:

- a technical public library especially for the young and newcomers
- a new ham station for its headquarters
- a VHF/UHF repeater to improve any emergency traffic in the northern part and neighboring areas
- a working group to establish some sort of cooperation with the local scouts for Jamboree On The Air activities in the future.

For additional information concerning this association, write to ARN, PO Box 34, Braganca 5300, Portugal.

QRM STRONGER THAN EVER

It is so common to hear whistles, steady carriers, and all sort of gremlins on the bands today when we are talking to someone. Let me tell you, sometimes I don't really know where good sense and respect for others have gone. Fortunately, we have exceptions. (Thanks to that, I'm still active.) Recently I was in a net and got sick from the things I heard. For heaven's sake, guys, don't do that, and never in a middle of the net operation. Be gentleman, and we will have a decent hobby.

I still remember when I was 14 years old and received my first license. I was just tuning up the rig with all that fourteen-year-old enthusiasm when a big shout came from my father: "What the hell are you doing, son? Have you checked out the frequency? Never do that again, or you will be in trouble with me! You got it?"

Twelve years have gone by, but I still remember this important rule: *Always ask, "Is this frequency in use?"*

VENEZUELA

Luis E. Suarez OA4KO/YV5
Apartado 66994
Caracas 1061-A
Venezuela

This month's column is devoted to call area 4 (Circuito 4) in this country. It is composed of the states of Carabobo, Aragua, and Cojedes, all located in the northern-central side of the country, facing the Caribbean Sea.

Cojedes State

The capital city of the state is San Carlos. It was founded by the Capuchin friars in 1678 and named for the saint who had been the Cardinal San Carlos of Austria. The city is situated in the midst of a booming region of ranching and rice, corn, sesame, cotton, and tobacco growing. The most highlighted city spot is the road-racing track, built on the northern outskirts in 1970, with seating capacity for 20,000 fans. Each March, San Carlos becomes, briefly, the center of the motorcycling world, when the trials and first race of the World Championship Series are run. The track's 2700 meters and seven curves are used also for international formula car races. But believe me, it gets terribly hot, with temperatures around 40 degrees centigrade, some 100 degrees Fahrenheit!

Carabobo State

Carabobo is by far the most flourishing industrial state in Venezuela. Its capital is Valencia. The site was selected during December, 1553, because it was a good place to raise cattle. The founder, Captain Vicente Diaz, bought animals in Margarita Island and drove them to Valencia in a 6-month trip. At that time, most people moved away from the coast to escape from marauders and pirates, but Valencia was not far enough to discourage attacks. In the next 400 years, Valencia was attacked many times.

In 1801, Valencia had a population of 6,548 people, and even the cities in the vicinity, Maracay and La Victoria, were both larger. Then, on March 26, 1812, at seven minutes past four, an earthquake struck and turned Valencia, Barquisimeto, Trujillo, and Merida into ruins. Ten thousand people died in Caracas, and all but three houses were destroyed in La Guaira, the port located 25 kilometers north from Caracas.

These calamities were followed by the battles of independence. It was near Valencia where the battle of Carabobo took place (June 24, 1821). There is a monument in that place that well deserves a visit. It is the most beautiful monument I have ever seen in South America and maybe represents not only the Battle of Carabobo but the independence of all Latin American countries as well.

The impressive monument in bronze and stone is located on the site of the battle itself and extends down a long formal avenue. A scale model at the information booth can be studied before you begin your walk. There you learn how the Spanish troops of General Miguel de la Torre faced the carefully-coordinated regiments under the command of Simon Bolivar, the lancers of Jose Antonio Paez, and the British Legion. The battle which followed is still studied in military schools as a masterpiece of strategy. 1000 soldiers died in an hour, including most of the officers of the British Legion. The most remembered death was that of Lt. Pedro Camejo, named Negro Primero (Number One Black), who rode up to General Paez at the height of the battle to cry: "My General, I have come to say good-bye, for I'm dead," and fell lifeless at his feet.

Visitors can see a 12-minute fragment of history in a Diorama cubicle with 22 minutes of explanation of the battle, with an electronic scale model in the Mirador, from which the panorama encompasses the whole battlefield. There is a lot of walking since the Mirador is 1 kilometer from the monument. Ten soldiers in the red uniforms of the times stand at attention, flanking the Tomb of the Unknown Soldier. There is a changing of the guard every two hours. If you ever come to Venezuela, don't forget a visit to this place.

It is noteworthy that Valencia was the country's capital three times, the last from 1859 to 1860. This did not mean the eclipse of the city. The first electricity plant in South America was erected here in 1876, and Valencia claims to be the first city on the continent to have had electric streetlights. There were no amateur-radio stations at that time, otherwise they also would have had the privilege to run on power supplies instead of batteries.

Aragua State

Aragua State is located to the east of Carabobo. It is the central agricultural zone (also radio call area 5). Its capital is situated on the northern shore of Lake Valencia and is just an hour car trip from Caracas. There are a number of national and recreational parks, of which the lake of Zuata is, to me, a particularly nice place. I have had the pleasure of flying a radio-controlled Catalina PBY model there, and believe me, I will never forget that day. After some 6 minutes of the first flight, I maneuvered the plane into an approach to land in a perfect smooth turn and dive, into the wind: the usual procedure: throttle back to half thrust, flaps down to 25 degrees. The plane came very easy and I throttled back to near idle when it was about 1 meter above the lake surface; it's a heavy ship and some speed is necessary for landing. The slightly nose-up attitude was near perfect. Suddenly, engine number two quit, causing the ship to swerve to one side and to plunge into the lake surface. The beautiful 2-engine Catalina, crashed and slowly sank. I lost 5 months of hard work, two motors, radio, batteries, and a beautiful PBY during the first and only six-minute flight.

On the way back to Caracas I even forgot to turn on the 2-meter radio, for I was trying to figure out just what happened. It was not pilot error, this time...

At the time of the Spanish conquest, the valley belonged to Cacique Maracay and his Aragua Indian tribe. Around the middle of the 16th century, a settlement began to grow here. The city of Maracay since then has become a city of high rises. It has six institutions of high learning and hundreds of factories located in its five industrial zones. Although it has more than 400,000 inhabitants, Maracay is still called the Garden City of Venezuela, as it has more square meters of green area than any other city in this country.

All the area of Circuito 4 is surrounded by mountains, so there are many repeater sites around here. The most notable are Pico Platillon, El Cafe, and El Socorro. Platillon is the best repeater site in Venezuela. It is very high and is located facing the plains to the south of the mountains. From this mountain you may link half of the country.

During the visit of Pope John Paul II, the Radio Club of Valencia commemorated that event with a special operation, using call 4M4SS during the period January 26-28. You may send QSL cards to PO Box 510, Valencia. The prefix 4M is used only for special events such as the operation from the Angel Fall, this past year, using the call 4M5ARV/6. The operation from the waterfall was organized by the Asociacion de Radioaficionados de Venezuela.

MAPS

Yes, I still like maps. City maps (not souvenir or tourist maps). If you would like a map of Caracas, just send me your city map. (Sorry, I have too many from some cities.) I have not received any maps from Europe! I will appreciate very much maps from Juneau, Honolulu, Sioux Falls (South Dakota), Tokyo, Moscow, Peking, Amman (perhaps King Hussein JY1 is reading this column!), Cairo, and specially Lima (Ohio) and Peru (Indiana). But any city is welcome. I wish to mention that some guys send more than one map. I really appreciate this, but I can only send just the map of Caracas in return.

A CASE OF PIRATING

Yesterday, February 14, at around 0200 UTC, I was tuning the 20-meter band. As expected, propagation was really bad and I heard just a couple of weak stations from Argentina. Then I heard the call of OA4BLY calling a station in Panama. Then he moved a little and called the station in Argentina I heard a minute before. The Peruvian station signed OA4BLY/MM and said he was sailing off the coast of Colombia heading to Panama, thus in the Pacific. His signal was S-9 plus 30 dB at my FRG-7700 and with a short indoor vertical collapsible antenna. No QSB, and also I heard some noise in the transmission background.

The guy at the speaker was no doubt Peruvian, for the accent was typical. But he was not sailing, I'm sure. In fact his transmission origin was, no doubt, not far from my QTH to the east of Caracas. I became so upset about this hoax that I switched off the radio and grabbed the *Callbook*. No OA4BLY. Also checked the *Amateur Radio Guide* of the Peruvian Radio Club and found no OA4BLY. Probably I'm wrong and he is legally licensed in Peru, but for sure he was not sailing off the Colombian shores. I feel very bad about this, and also feel very angry when I receive QSL cards at my address in Peru for a QSO I never did, for I'm residing in Venezuela for the 12 years.

HAM HELP

Would someone please help me find a schematic and instruction manual for the General Radio Impedance Bridge type 1650-A? I will gladly pay any cost incurred.

Torgny Karlsson SM7CFQ
Sandomavagen 7
S-280 41 Nyhamnslage
Sweden

I sorely need a functioning Callfone AV-25 or equivalent, or just the circuit board, mike, jack panel, and battery door.

J. Spencer Thornton
Box E 142902
Jackson MI 49204

I need a copy of a manual for a military-type rf signal generator, model TS-510A/U.

Brian Iehl KA9MQE
4213 N. Ridgeway
Chicago IL 60618

Are there any Timex-Sinclair computer magazines or newsletters still being published? If so, what are their addresses? I'm also looking for a list which will give the "civilian" numbers for military VT tubes.

Gary Payne KE6CZ
1347 Dakota
Fresno CA 93704

So You Want To Try Something New? How 'Bout The AEA Packet Breakthrough!

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Frequency in use? No problem!! Jump right in and transmit!!
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RTTY is too slow? "Packet away" at up to 1200 baud or more.

In Packet Radio, your station is a radio, a computer terminal, and a TNC (Terminal Node Controller, hopefully the AEA PKT-1). You type and the TNC sends short bursts (packets) of two-tone modulation called AFSK. The other station decodes them and displays them on his monitor screen. He then sends to you.

There is a lot of activity—local clubs, voice nets, mailboxes/bulletin boards, links between bands, long range (digi)repeaters and chained digipeaters, voice nets, search/rescue and emergency work, newsletters, satellite communications, technical development of new equipment and software, etc. 220 MHz will be very important to packet radio. Help us populate it and "Save the Band"!! We need your help and participation.

AEA Packet Radio
RAM length is 2000
cmd: connect to N7ML via KB7G, K6RFK
cmd: ***CONNECTED TO N7ML
Hi Mike - have you seen the great new AEA PKT-1?
YES JOHN - LOOKS GOOD K
Bye Mike sk
cmd: ***DISCONNECTED
cmd:

Packet radio is:

Standardized—your station can talk to any other packet station.
Popular—fast growth over the last year to about 2000 stations in the U.S.
Multi-frequency—10.147, 14.103, 145.832, Oscar 10, 145.01 (and other local 2M frequencies) are being used now.
Public Service—traffic handling, search and rescue, public events, emergency service.
Multimode—conventional radio, meteor scatter, but no EME/moonbounce yet (will you be first?).
Simple—you control the PKT-1 by typing 5-6 simple one- to four-letter command words on the terminal or computer. Several of them are shown in the above monitor screen simulation, which shows a connect via digipeaters, and an interchange between two stations.

It's easy to get going. You probably already have the radio, and the computer or terminal. You'll need to operate your computer in RS232C mode using "communications terminal" software that is free or cheap. We can usually furnish information on what to use for popular computers. The rest of the software is resident in the PKT-1 (you will need to buy a PKT-1). And you need a MIC connector to connect to the (furnished) radio cable you'll plug into your radio MIC jack. And "BRAAP," you're on the air with "Packet Racket."

You're likely aware of Packet Radio already. If not, read WB4GXD's three excellent tutorial articles in the Sept. and Oct. '83 and Jan. '84 issues of *73*. Clip the coupon below, and we'll send articles, a reading bibliography, product literature on our PKT-1 Packet Controller, answers to commonly asked questions about packet radio, lists of packet clubs in your area, sample packet newsletters from the ARRL and clubs, AEA dealer locations, packet videotape and audio cassette loan info, voice net info on HF/VHF where you can listen and ask questions, a blow-by-blow description of how easy it is to get started, a free AEA Packet Lapel Button, AND WE'LL PUT YOU ON OUR PACKET MAIL LIST to ensure you'll get further mailings!!!

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Bay area's newest amateur radio store. New & used amateur radio sales & service. We feature Kenwood, ICOM, Arden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1775A S. Winchester Blvd., Campbell CA 95008, 370-6865.**

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Factory Authorized Dealer! Yaesu, ICOM, Ten-Tec, KDK, Kenwood, AEA, Kantronics, Santec. Full line of accessories. No sales tax in Delaware. One mile off I-95. **Delaware Amateur Supply, 71 Meadow Road, New Castle DE 19720, 328-7728.**

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Ron WB7BYZ has the largest stock of amateur gear in the Intermountain West and the best prices. Call me for all your ham needs. **Ron Distributing, 78 So. State, Preston ID 83263, 852-0830.**

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Serving the ham community with new and used equipment. We stock and service most major lines: AEA, Astron, Azden, B&W, Cushcraft, Hy-Gain, Hustler, ICOM, Kenwood, KLM, Larsen, Mirage, Mosley; books, rotors, cable and connectors, Business hours 9–7 Monday through Thursday, and 9–5 Friday and Saturday. **Rivendell Electronics, 8 Londonderry Road, Derry NH 03038; 434-5371.**

Albany, New York
UPSTATE NEW YORK

Kenwood, ICOM, Ten-Tec, Belden, Cushcraft, Larsen, Hustler, ARRL, Hy-Gain, B&W, MFJ, Mirage. New and used equipment. Serving the amateur community since 1942. **Adirondack Electronics, Inc., 1091 Central Avenue, Albany NY 12205, 456-0203** (one mile west of Northway exit 2W).

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The biggest and best ham store in the Midwest featuring Kenwood and other quality products with working displays. We sell only the best. Authorized Kenwood service. **Universal Amateur Radio, Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.**

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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the October '85 issue must be in our hands by August 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
ARGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40[1]	40		15	15	15	10	10
ENGLAND			40[1]	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40[1]	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40[1]	40		15	15	15	10	10
SOUTH AFRICA			40	40		20	20				20	
U. S. S. R.							20	20		20		
WEST COAST	20	40	40	40[1]	40[1]	40						20

CENTRAL UNITED STATES TO:

ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40[1]	40		20			20	
CANAL ZONE	15	20	20	20	40[1]	40	20	20	15	15	15*	10
ENGLAND	20	40					20	20		20	20	20*
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40[1]	40	20	20	15	15	15*	10
SOUTH AFRICA							20				20	20
U. S. S. R.								20			20	

WESTERN UNITED STATES TO:

ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40[1]	40[1]		20		15	15
CANAL ZONE	15	15	20	20[1]	40[1]	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20[1]	40[1]	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20[1]	40[1]	40		20	20	15	15	15
SOUTH AFRICA			40						20			
U. S. S. R.									20			
EAST COAST	20	40	40	40[1]	40[1]	40						20

1 = Possible 80-meter openings.
*** = Check next higher band.**

G = Good, F = Fair, P = Poor.

JULY

SUN	MON	TUE	WED	THU	FRI	SAT
	1 G	2 F	3 G	4 G	5 G	6 G
7 G	8 G-F	9 F	10 F-P	11 F	12 F-G	13 G
14 G-F	15 F	16 F-G	17 F-P	18 P	19 P	20 P-F
21 F-G	22 G	23 G	24 G	25 G	26 G	27 F
28 G	29 G	30 G	31 G			

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When Bobby Jones wants to call home, he pushes one button.

THE CES MICRODIALER

- *21 digits per memory*
- *10 number autodial*
- *20 digit last number redial*
- *Field programmable ANI*

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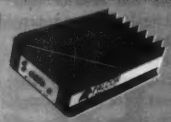
Or call toll-free (800) 327-9956 ext. 272 *(Orders Only Please)*

FALCON COMMUNICATIONS



AFTER A LONG INVESTIGATION AND EVALUATION, EVERETT L. GRACEY, FORMER CO-OWNER OF MIRAGE COMMUNICATIONS, HAS JOINED FORCES WITH FALCON.

A FEW FEATURES:
- All-mode BIPOLAR Mobile/Base Amplifiers
- All-mode MOSFET Mobile/Base/Repeater Amplifiers
- "Real" Repeater Amplifiers (*not* the add-on type)
- *Optional* Plug-in Receiver Preamplifiers (not everyone needs a receiver preamplifier)

ALL-MODE BIPOLAR AMPLIFIERS

Model 5123 (2-Meter Amplifier) ..... List $235
25 Watts *in* = 150+ watts *out*
10 Watts *in* = 90 watts *out*

Model 5121 (2-Meter HT Amplifier) ..... List $285
2 Watts *in* = 150 Watts *out*
1 Watt *in* = 90 Watts *out*

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30 Watts *in* = 120 Watts *out*
10 Watts *in* = 80 Watts *out*

Model 5125 (70-Cm Amplifier) ..... List $305
3 Watts *in* = 100 Watts *out*
1 Watt *in* = 40 Watts *out*

MOSFET POWER AMPLIFIERS
(Same Ranges as Bipolars) ..... Send for Prices)

MOSFET REPEATER AMPLIFIERS

Model 4111 (2-Meter Repeater Amplifier) ..... List $295
20 Watts *in* = 100 Watts *out*
10 Watts *in* = 90 Watts *out*
2 Watts *in* = 30 Watts *out*

Model 4114 (2-Meter Repeater Amplifier) ..... List $365
2 Watts *in* = 100 Watts *out*
1 Watt *in* = 80 Watts *out*

Model 4112 (1¼-Meter Repeater Amplifier) ..... List $295
25 Watts *in* = 100 Watts *out*
10 Watts *in* = 70 Watts *out*

Model 5142 (70-Cm Repeater Amplifier) ..... List $375
30 Watts *in* = 100 Watts *out*
10 Watts *in* = 40 Watts *out*

For more information see your local dealer or call factory for details.

Post Office Box 8979
Newport Beach, CA 92658
Telephone: (714) 760-3622

With SMART PATCH You are in CONTROL

With CES 510SA Simplex Autopatch, there's no waiting for VOX circuits to drop. Simply key your transmitter to take control.

SMART PATCH is all you need to turn your base station into a personal autopatch. SMART PATCH uses the only operating system that gives the mobile complete control. Full break-in capability allows the mobile user to actually interrupt the telephone party. SMART PATCH does not interfere with the normal use of your base station. SMART PATCH works well with any FM transceiver and provides switch selectable tone or rotary dialing, toll restrict, programmable control codes, CW ID and much more.

To Take CONTROL with Smart Patch – Call 800-327-9956 Ext. 101 today.

What To Look For In A Phone Patch

The best way to decide what patch is right for you is to first decide what a patch should do. A patch should:

- Give complete control to the mobile, allowing full break in operation.
- Not interfere with the normal operation of your base station. It should not require you to connect and disconnect cables (or flip switches!) every time you wish to use your radio as a normal base station.
- Not depend on volume or squelch settings of your radio. It should work the same regardless of what you do with these controls.
- You should be able to hear your base station speaker with the patch installed. Remember, you have a base station because there are mobiles. ONE OF THEM MIGHT NEED HELP.
- The patch should have standard features at no extra cost. These should include programmable toll restrict (dip switches), tone or rotary dialing, programmable patch and activity timers, and front panel indicators of channel and patch status.

ONLY SMART PATCH HAS ALL OF THE ABOVE.

Now Mobile Operators Can Enjoy An Affordable Personal Phone Patch. . .

- Without an expensive repeater.
- Using any FM tranceiver as a base station.
- The secret is a SIMPLEX autopatch, The *SMART PATCH.*

SMART PATCH Is Easy To Install

To install *SMART PATCH*, connect the multicolored computer style ribbon cable to mic audio, receiver discriminator, PTT, and power. A modular phone cord is provided for connection to your phone system. Sound simple? . . . IT IS!

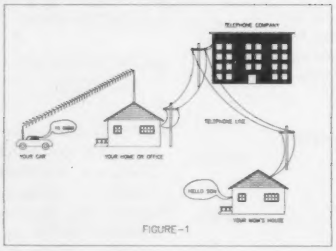

FIGURE-1

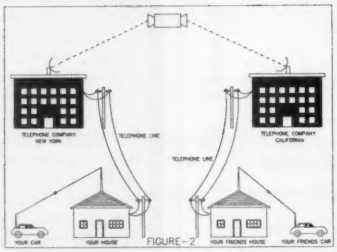

FIGURE-2

How To Use *SMART PATCH*

Placing a call is simple. Send your access code from your mobile (example: *73). This brings up the Patch and you will hear dial tone transmitted from your base station. Since *SMART PATCH* is checking about once per second to see if you want to dial, all you have to do is key your transmitter, then dial the phone number. You will now hear the phone ring and someone answer. Since the enhanced control system of *SMART PATCH* is constantly checking to see if you wish to talk, you need to simply key your transmitter and then talk. That's right, you simply key your transmitter to interrupt the phone line. The base station automatically stops transmitting after you key your mic. *SMART PATCH* does not require any special tone equipment to control your base station. It samples very high frequency noise present at your receivers discriminator to determine if a mobile is present. No words or syllables are ever lost.

SMART PATCH Is All You Need To Automatically Patch Your Base Station To Your Phone Line.

Use *SMART PATCH* for:

- Mobile (or remote base) to phone line via Simplex base. (see fig 1.)
- Mobile to Mobile via interconnected base stations for extended range. (see fig. 2.)
- Telephone line to mobile (or remote base).
- *SMART PATCH* uses SIMPLEX BASE STATION EQUIPMENT. Use your ordinary base station. *SMART PATCH* does this without interfering with the normal use of your radio.

WARRANTY?
YES, 180 days of warranty protection. You simply can't go wrong.
An FCC type accepted coupler is available for *SMART PATCH.*

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Presenting two small cases for a lot of mobile power.

You won't find a 45-watt, 2-meter FM mobile rig that's built smaller than the Yaesu FT-270RH.

Nor will you find a dual-band FM mobile that offers the crossband full-duplex capability found in the 25-watt Yaesu FT-2700RH.

It shouldn't be surprising. We've been coming up with a lot of innovative concepts lately.

The FT-270RH measures just 2 x 6 x 7 inches. Conveniently fitting its high-power punch into many small spaces of your car. Places where other 45-watt mobiles just won't fit.

The FT-2700RH is small too. Smaller than other dual-banders. But with one big difference: a "DUP" button. Push it, and you're operating full duplex, 2 meters on one VFO, 440 MHz on the other. Each at 25 watts. So you can simultaneously transmit and receive in true telephone style.

Once installed, you'll find the FT-270RH and the FT-2700RH equally simple to operate. Just turn the rig on, dial up a frequency, select offset or duplex split, and you're on the air.

Each rig gives you 10 memories for storing your favorite frequencies. Dual VFO capability. A clean, uncluttered LCD display for easy readout. Push-button jumps through the band in 1 MHz steps. Band scanning with programmable upper and lower limits. And priority channel operation.

You don't even have to take your eyes off the road to determine your operating frequency and memory channel. An optional voice synthesizer announces them both at the push of a button on the microphone. The FT-2700RH announces both your 2-meter and 440 MHz operating frequencies.

Also, tone encode and encode/decode capability is programmable from the front panel, using an optional plug-in board.

So when you need a lot of power in a compact mobile radio, discover Yaesu's FT-270RH and FT-2700RH. There's nothing else like them on the road.

YAESU

Yaesu Electronics Corporation
6851 Walthall Way, Paramount, CA 90723
(213) 633-4007

Yaesu Cincinnati Service Center
9070 Gold Park Drive, Hamilton, OH 45011
(513) 874-3100

Prices and specifications subject to change without notice.

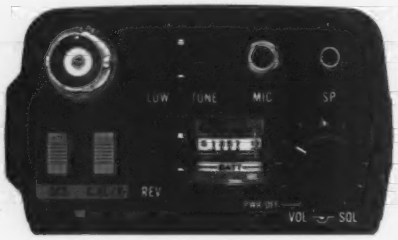
KENWOOD

pacesetter in Amateur radio

Handy Handful...

TR-2600A/3600A

Kenwood's TR-2600A and TR-3600A feature DCS (Digital Code Squelch), a new signalling concept developed by Kenwood. DCS allows each station to have its own "private call" code or to respond to a "group call" or "common call" code. There are 100,000 different DCS combinations possible.



- **Simple to operate**
  Functional design is "user friendly." Built-in 16-key autopatch encoder, TX STOP switch, REVerse switch, KEYboard LOCK switch, high efficiency speaker.
- **Large LCD**
  Easy to read in direct sunlight or in the dark with convenient dial light that also illuminates the top panel S-meter.
- **Extended frequency coverage**
  Allows operation on most MARS and CAP frequencies. Receive frequency range is 140-160 MHz; transmit capability is 142-149 MHz, (TR-3600A covers 440-450 MHz).
- **Programmable scan**
  Channel scan or band scan, search for open or busy channels.
- **SLIDE-LOC battery case**
- **10 Channels**
  10 memories, one for non-standard repeater offsets.
- **2.5 watts high power, 350 mW low**
  TR-3600A has 1.5 watts high or 300 mW low.

The Kenwood TR-2600A and the TR-3600A pack "big rig" features into the palm of your hand. It's really a "handy handfull"!

Optional accessories:

- TU-35B built in programmable sub-tone encoder
- ST-2 base stand
- MS-1 mobile stand
- PB-26 Ni-Cd battery
- DC-26 DC-DC converter
- HMC-1 headset with VOX
- SMC-30 speaker microphone
- LH-3 deluxe leather case
- SC-9 soft case with belt hook
- BT-3 AA manganese/alkaline battery case
- EB-3 external C manganese/ alkaline battery case
- RA-3 telescoping antenna
- RA-5 2-m/70-cm telescoping antenna
- CD-10 call sign display
- BH-2A belt hook

More TR-2600A and TR-3600A information is available from authorized Kenwood dealers.

KENWOOD

TRIO-KENWOOD COMMUNICATIONS
1111 West Walnut Street
Compton, California 90220

TR-2600A shown. TR-3600A is available for 70 cm operation.
Complete service manuals are available for all Trio-Kenwood transceivers and most accessories.
Specifications and prices are subject to change without notice or obligation.